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UNITED STATES ARMY AVIATION DIGEST

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SEPTEMBER 1962 VOLUME 8 NUMBER 9

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The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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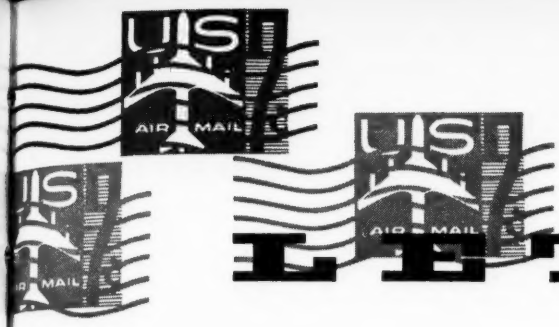


LETTERS

Sir:

This idea belongs to Capt Edward R. Brophy, currently assigned to the air unit of the maintenance section, Transportation Office, at Hq First Army, Fort Jay, Governors Island, New York.

Happens I caught him walking around with a handball glove on his left hand, from which all the fingertips had been cut off. This gives him a "no-sweat" palm grip for his collective in warm weather operation.

Sorry I didn't have a chance to photograph his hand before he went cloud scouting.

Hope you find this idea useful for a brief hot weather blurb.

SEYMOUR REITMAN
PS Magazine

● *Thanks for the tip. We hope all personnel interested in the Army Aviation program will send us similar items for dissemination.*

Sir:

Let me first congratulate you and your staff on the increasing quality of the DIGEST. I have long felt that Navy's APPROACH is the finest professional aviation publication going, but I feel that the DIGEST is fast "approaching" this standard of excellence.

Now that we have started pleasantly enough, on to the point at hand. I have been humiliated by the DIGEST and, I suspect, the USABAAR Literature Division. Shortly after becoming aviation safety officer last November, I asked a question of the Sixth Army ASO concerning "precautionary landings." The reply was explicit. "Captain, there is no such terminology in the regulations. AR 385-40 spells out very clearly that when continued flight is inadvisable or impossible, it is a forced landing!"

Immediately thereafter when a C-47 from our field lost an engine, the IP, a loyal compatriot, administered a severe tongue-lashing for sending a Crash Facts message citing the *forced landing.* "We could have flown all day on number one," he stated. "It was a *precautionary landing!*" Armed with my regs I explained, and he conceded. Imagine my chagrin when he entered my office the other day and threw the DIGEST open to page 39. "AO-1 yawed and rolled . . . and aircraft completed PRECAUTIONARY LANDING . . ."

My faith is shaken; my fellow aviators doubt my reliability; dogs growl and snap and little boys laugh and point as I pass them by, a broken man. I have a last wish before I reach the very bottom of the bottle. I want to know if, according to Linus of Peanuts fame, there is a great pumpkin—a *precautionary landing.* Perhaps this character assassination was caused by a misprint, or maybe the changes to 385-40 are slow getting here by mule, but please clarify this point for the sake of aviation safety in the lonely desert.

WILLIAM H. LUTHER
Capt, Inf
Aviation Safety Officer

Dear Captain Luther:

We did it!

We have received the information copy of your letter to the editor of the DIGEST chasing the phraseology forced landing-precautionary landing semantic battle down the road.

The Sixth Army ASO you quoted was quite correct: the regulation (AR 385-40) does not deal in the verbiage of "precautionary landing." You, in turn, were quite right in sending out a "Crash Facts" message classifying a C-47 (R4D) engine out, citing the incident (not "Incident" as defined in Par 27, AR 385-40, but "incident" meaning "occurrence") as a forced landing as defined in Par 26, AR 385-40.

The writer of "TWX Excerpts" in the May 1962 issue was also quite correct in his use of the vocabulary. The occurrence (I dare not again use the term "incident") was rightly classed as a "forced landing" by the originator, our code clerk, and finally by our Mr. IBM itself. The crew did perform a "precautionary landing" with two engines producing power after experiencing a real "thriller," and we coded the incident (occurrence) as a "forced landing." (Quite honestly, we don't care what occurrences are called as

long as we get the information.)

A word to your compatriot who administered the tongue-lashing and barreled forth with the cliche, "We could have flown all day on number one." Perhaps he could have, and perhaps we shall read more of him. Let's hope not.

Education and Literature Division
USABAAR

Sir:

Just a short note to remind H-13 mechanics to keep their fingers out of controls in front of those fans. The fans have a nasty habit of taking those same fingers and making them go away to places where you cannot find them. I know. I even did it with a pair of gloves on.

• *Forwarded from APPROACH magazine.*

Sir:

What kind of spelling and what kind of editing goes on there? Lieutenant Shabram's interesting "Aerial Photography" on p. 38 of your June issue mentions, several times, the general-in-chief of the United States armies during the Civil War time as General McLennan.

George Brinton McClellan did not spell it that way. This error doesn't seem worthy of your good magazine. Maybe Lieutenant Shabram is safer in the camera pod or on the ground.

E. M. CHARBO
Topeka, Kansas

• *Indeed we goofed, but promise to spell McClennon, er McLennan, McClellan! korrectlly in future issues.*

Sir:

In the September 61 DIGEST there was a filler out of the APPROACH called "A Pilot's Parable of P's." Here's one of my own:

PALTRY PM PRECLUDES PERPETUAL PLANE PERFORMANCE

Prescribed
PM
programs
perceive
perceptable
problems,
provide
perfect
plane
performance;
preventing
potentially
precarious
predicaments,
possible
parachute
plunges,
probable
persistant
perspiration,
provocations
producing
profanity;
permitting
proficient,
progressive
personnel
prompt
promotions...
perhaps!

ALAN W. BOURNE
Capt, Arty, Wyo ARNG

Could the helicopter have been used successfully in raids of past combat actions?

Raid Type Operations

Via Helicopter Airmobile Forces

Major Billy L. Odneal

POSSIBLE NUCLEAR warfare places a tremendous responsibility on today's field commanders to keep their troops dispersed. With this thought in mind, the raid type operation could well become a primary type of operation, not only against widely dispersed opposing armies but more and more against isolated areas and the strategic abilities of the opposing nations.

Raids are normally executed in hostile territory to neutralize enemy forces, installations, facilities, headquarters or personalities. A planned withdrawal is made when the assigned mission is completed. The contribution of the helicopter in such missions is determined by how it will aid or limit the operation.

Some of the characteristics of a helicopter airmobile force as opposed to other means of transport are:

Landing of troops and equipment in combat as organized tactical units is achieved. This permits immediate control by the troop leader over his men during the most critical period of the assault.

A force may be landed in its selected formation for the assault. The supporting arms can be properly disposed in relation to the direction of the attack.

Few areas are restricted to helicopter landings and even in these areas the helicopters can normally hover while loading and unloading.

The troop elements of helicopter airmobile assault forces, when in the air, can alter their landing formation.

These forces can seize objectives in areas inaccessible to other modes of transportation.

Conventional ground fortified areas can be ignored, assaulted from the rear, or enveloped with relative ease.

Raiding operations are offensive land operations in enemy held territory, carried out by forces who intend to withdraw. Such operations may be strategical or tactical and need not be directly connected with the main battle. Raiding parties may be transported by land, sea, air, or combinations thereof.

Raids are usually undertaken with one or more of the following aims:

To reduce the enemy's front line effort by forcing him to deploy to guard key points throughout the area occupied by his forces.

To destroy targets whose elimination will have a major influence on the course of the war.

To collect intelligence.

To give support to partisan operations behind the lines.

The possible tasks for raiding forces may be grouped as follows:

Short term tactical operations closely related to the main battle.

Strategic operations possibly in conjunction with friendly partisans.

Reconnaissance operations.

Special tasks.

All of these tasks can be further divided into two main catagories: large scale operation by a force of battalion strength or more, and raids by small parties.

The helicopter can be used for raids in four major ways:

Maj Odneal is project officer Armament Branch, Aircraft Division, U. S. Army Aviation Board, Ft Rucker.

• To carry the raiding party to the objective, wait and evacuate upon completion of the mission.

• To carry the raiding party to the objective, return to friendly lines, return on call or at a designated time and place to evacuate.

• To evacuate a raiding party which has reached its objective by another means.

• To carry a raiding party to an objective; evacuation to be by other means.

A raid, by necessity, must be extensively planned. Nothing must be left to chance; every eventuality must be prepared for. Every available collection agency must be used to obtain information on the strength, location, and activities of the enemy. This information will determine the objective landing sites, evacuation points, types of delivery, flight routes, ground routes, equipment required, size of party, the ground tactical plan, the time of attack, and many other considerations.

The use of helicopters for transport gives the planner a great deal of flexibility. Some advantages of this mode of transport:

Avoidance of detection by the enemy by using minimum terrain clearance flight routes through enemy controlled territory.

Ability to fully utilize the element of surprise if such routes are used.

Elaborate preparations and special training needed for an airborne or amphibious raid are not required.

Elaborate security precautions required in airborne or amphibious raids are not needed.

Natural and man-made obstacles to raids using other means of transport need not be considered except as possible aids.

Raiders can be given a multitude of missions if it becomes necessary to divert from the original mission.

Some of the major benefits accrued by the tactical commander:

Complete command of the force at all times.

The force is never irrecoverably committed.

Flight routes, landing sites, evacuation sites are all flexible.

A rapid withdrawal is possible.

Multi-missions not restricted to

one locality can be performed.

Obstacles to other means of transport are not a hindrance, but may become an aid.

The unit can be committed in almost any direction.

For the most part, disadvantages are minor. Nevertheless they should be mentioned.

The helicopter has a limited range. (This may be partially eliminated by using helicopters with other means of transportation, i. e., naval carriers, assault aircraft, and by air-to-air refueling or refueling from caches or at partisan controlled areas.)

The helicopter is vulnerable to small arms and artillery type antiaircraft fire and missiles. (This may be overcome by careful planning of the flight route and choice of altitude; also suppressive fires and deception.)

A great deal of maintenance is required to keep usable aircraft at a high rate of availability. (However, as was the case with the tank and with fixed wing aircraft, technological advances can overcome this.)

The problem of pinpoint accuracy in low-level navigation over extended distances is present. (However, proper training can overcome this problem, and scientific advances in this field may completely solve the problem.)

Could the helicopter have been used in successful raids for past combat actions?

Bruneval Raid

Consider the 1942 British raid on Bruneval. On this raid British paratroopers were landed on the French coast near Le Havre to capture and evacuate valuable German radar equipment and operators, and, if possible, to destroy the station and withdraw. This entailed a neat and intricate operation in which ground, air, and sea elements would participate. It involved extensive planning to coordinate all three services, the best possible weather and tides, a diversionary bombing raid, and securing the beach for the withdrawal. Since most of the withdrawal had to be executed by daylight, fighter cover had to be arranged.

Planning, training, and rehearsing took two months, with everything dependent upon maintaining the secrecy of the mission. (While the landing party waited off shore to load the returning raiders, two German destroyers accompanied by "R" boats passed within a mile and were seen by many anxious eyes. Luckily, they took no action. Had they done so, the operation could have failed.)

Using helicopters, this force could have taken off from England during the hours of darkness, flown the raiders directly to Bruneval, remained in place and evacuated them, the captured personnel and equipment all within a few hours—the entire operation taking place during the hours of darkness.

By using helicopters, it is estimated that the initial coordinating, training, and rehearsing time could have been cut by at least 75 percent. The only joint action necessary would have been a diversionary bombing raid, and normal rescue operation in event a chopper went down in the channel. The need for a beachhead for evacuation, fighter cover, specialized airborne training for the troops and the technicians who were to dismantle the radar equipment, and the waiting for ideal weather and proper tides would have been eliminated.

Enemy naval craft in the immediate areas would have caused only a change in flight path. The fear of detection would have been greatly minimized. These obvious advantages, and many more less apparent, point out that had helicopters been available, they would probably have been used. This type mission would be ideal for the use of helicopters.

Los Banos Raid

This raid illustrates a type operation in which the raiders could have been carried in, dropped off, and the helicopter returned later to pick them up.

In February 1944 American forces planned a raid on Los Banos in the Philippines. Purpose: to seize and evacuate some 2,300 internees, mostly American civilians, from the Japanese internment camp at Los Banos.

The plan was extremely detailed and involved great secrecy, for if plans of the liberation leaked out the operation was doomed to failure and the internees to possible execution. A large coastal section, the Laguna de Bey, had to be seized; and a diversionary threat to the south had to be established that would not jeopardize the operation. An estimated 253 Japanese garrisoned the camp, and the Japanese 8th Division was located in the general area.

The forces involved were a reconnaissance platoon and guerrillas, who were to eliminate the sentries, and a reinforced parachute rifle company (one mortar section and a machinegun platoon attached) to be dropped simultaneously from ten C-47 aircraft. Their mission was to overpower the defensive garrison and segregate the internees.

The evacuation of the raiders and internees was accomplished by a parachute battalion, less a

reinforced company, with 53 amtracks over a distance of 25 miles, one way. This unit had the additional mission of securing, with the parachute force, the camp and beaches during the evacuation. The final phase was the use of a diversionary marching force to keep the 8th Japanese division busy.

The use of helicopters would have saved manpower and given better odds on the success of the mission. Fewer troops would have been involved; therefore, a better chance for security, more assurance of the parachute company hitting the objective at the exact time required, and no necessity for the seizure of the beachhead. The time involved, allowing 40 persons per helicopter and 30 minutes a round trip, would have been less than 2 hours and would have required approximately 40 helicopters. With this speed, a large diversionary effort would hardly have been necessary. Planning, training, and rehearsing time would have been cut by an estimated 50 percent. **The most important advantages would have been the easier maintenance of secrecy and flexibility of plans,** permitting changes up to the last possible minute, and in allowing for any enemy action or unforeseen events which may have hindered or caused failure of the conventional type raid.

Skorzeny Raid

An example in which the raiding force would only be *evacuated* by helicopter can best be illustrated using the raid, by Captain Skorzeny of the German Army, to rescue Benito Mussolini from a hotel on a ledge near Aquila, Italy.

The Germans landed by glider under hazardous conditions near the hotel, and within 3 minutes (estimated by Captain Skorzeny) it was in German hands. Originally the force was to be evacuated by aircraft, but at the last moment the evacuation planes could not be contacted and a supplementary plane had damaged its landing gear and could not take off. A spotter plane was able to land on the hotel ledge and evacuated Mussolini and Skorzeny.

The critical features of this raid were the dependency on surprise, timing, and evacuation. Captain Skorzeny had estimated it would take 3 minutes to get to Mussolini and that during this time the guards would be too dumbfounded to react. This was the case; however, the entire operation almost failed due to a communications breakdown and the accident to the supplementary plane's landing gear.

In this example, helicopters probably would not be used initially because of the noise; however, after the limited assault and rescue, they could easily have been used for the evacuation of the entire raiding party. The fate of the operation would not have depended on the ability of a spotter aircraft to land on the ledge at the hotel. Possibly the helicopters might have been used in the assault. However, had they been available they would probably have been used in the evacuation.

Dien Bien Phu Raid

In this raid helicopters could have been used for the delivery of a raiding force, evacuation to be accomplished by some other means or at a much later date. The raid by the French at Dien Bien Phu against the Vietminh forces in November 1953 was to secure an isolated airhead which as a base of operation would allow the French to deny the Vietminh lines of communication and approach by offensive sorties. Of primary interest, the operation would also stop the Vietminh 316th Division from accomplishing its probable mission of eliminating French Union garrisons and French sponsored guerrillas in Western Tonkin and Northern Laos.

Three parachute infantry battalions initially launched a parachute assault which achieved complete surprise and seized Dien Bien Phu and destroyed or drove off the existing troops. The garrison was subsequently reinforced by air by three more airborne battalions. When it became evident the Vietminh would make an all out counterattack on Dien Bien Phu, the French elected to defend. This was a calculated risk based on the assumptions that French tactical air supremacy would permit effective interdiction of Vietminh communication routes and neutralization of enemy artillery, as well as filling the requirements of French supply and evacuation. These two assumptions failed to occur.

Helicopters could have been used twice in the "drop off" method. Initially, they could have been used to transport the French forces to Dien Bien Phu in conjunction with airborne troop delivery, as the attack echelon, and reinforce them later. This would ensure the landing of selected forces on exact key objectives. The second way would be by transporting the entire raiding force, or a smaller force initially, to seize

key objectives, including the airfield, allowing the reinforcing element to be air-landed. The latter means would allow a great savings in training as no airborne troops would have been necessary. Had the helicopters been used in conjunction with airborne troop delivery they would have given a greater assurance of the success of the mission.

During the defensive phase of the operation the helicopters could have been used to carry raiding parties to neutralize the enemy artillery, interdicting the lines of communication and supply. As the raiders withdrew to Dien Bien Phu they could have destroyed the rice crops and made the water supplies unusable. Raiding of this type would, of necessity, be limited, lightning swift, and to an exact objective initially with a multitude of objectives assigned on the withdrawal. Other helicopters could have been used in conjunction with these operations to reinforce and resupply the main garrison and evacuate the wounded at Dien Bien Phu.

The tremendous flexibility given the French commander by using helicopters would have made it extremely unlikely that the French garrison could have been taken under siege. Had the siege been possible regardless, helicopters could have been used to evacuate the French from many different loading zones to another strong point selected by the higher command, and the entire sequence started over again. Airfields in this case would have been of a secondary concern, or none at all.

British Malayan Operation

Another example is the British operations in Malaya against the communist guerrillas. These guerrillas, known as the Malayan Race's Liberation Army (MRLA), had as objectives almost everything which existed in the settled areas. They operated from a safe base against vulnerable objectives, and escaped into the jungle. Their food came from Chinese squatters who grow food along the edge of the jungle. The MRLA had a complete network of camps within the jungle and when attacked simply retreated to another camp. With only one main path into these camps, it was a simple matter to post an alarm sentry. The attackers were generally too worn and tired to follow and generally had to be resupplied by this time. Then, too, the track generally went into a stream or onto a well traveled path where it was impossible to follow.

The British who unfortunately had only a few helicopters which arrived late in the campaign, combated this situation by using patrols which, after they obtained information of a MRLA camp, took a party to capture and destroy the camp and its inhabitants. This is very difficult for many reasons. Guides must be used, and it is extremely difficult to navigate and maneuver in the jungle.

Helicopters could be used in this type of operation by carrying the raiders to the camps and dropping them off on the camp itself or the routes into and out of the camps. After destruction of the camp and capture or destruction of the enemy, the raiders could then destroy food supplies and sources while returning to their base.

This would have given the British the advantages of surprise, the ability to come in right on the camps or on the route into or out of the camp, thus effectively blocking the guerrillas so they would either have to surrender or be destroyed. The helicopter would also have given the British the ability to resupply their patrols at will at exact points and to evacuate their wounded in a matter of minutes. The greatest advantages would have been in the flexibility of a proportionally smaller British force and the great savings in time. What would take a ground force days and weeks to accomplish could be done in a matter of hours by helicopter.

These methods of helicopter utilization have been hypothetical, applied under given assumptions. The advantages have been derived by deduction of what is felt to be obvious and practical uses. Of course these are not the only ways helicopters could be utilized. It is felt any other use, however, must involve one of the above methods to some extent.

In no operation should the helicopter be considered as the only method of transportation; it should be considered with all other available means. In this way, more and greater flexibility is given to the helicopter and to the other means also. As a result the commander has greater flexibility in all means and methods of transporting troops and equipment.

The advantages of using helicopters in these type operations have been made obvious and can be summarized as:

- Time.
- Airborne training as such is not required for air transport of raiders.
- Planning is cut nearly 50 percent.

- Rehearsal time and effort is reduced.
- Obstacles which hamper raids made by other means of transport are no longer a detriment but can be an asset.
- Time of movement is reduced.
- Secrecy and conservation.
- Fewer troops and equipment are needed.
- Multi-routes of attack can be used.
- Fewer areas are required.
- Multi-missions can be assigned.
- The enemy must disperse to cover entire zone.
- Flexibility and mobility are given to planner and executor.
- The force need not be committed until the last possible moment.
- Natural phenomena interference (such as weather) minimized.
- Tactical commander is in direct command at all times.
- Morale is increased and more easily maintained.

Such helicopter airmobile raids can give the Army commander a new and broader concept of operations.

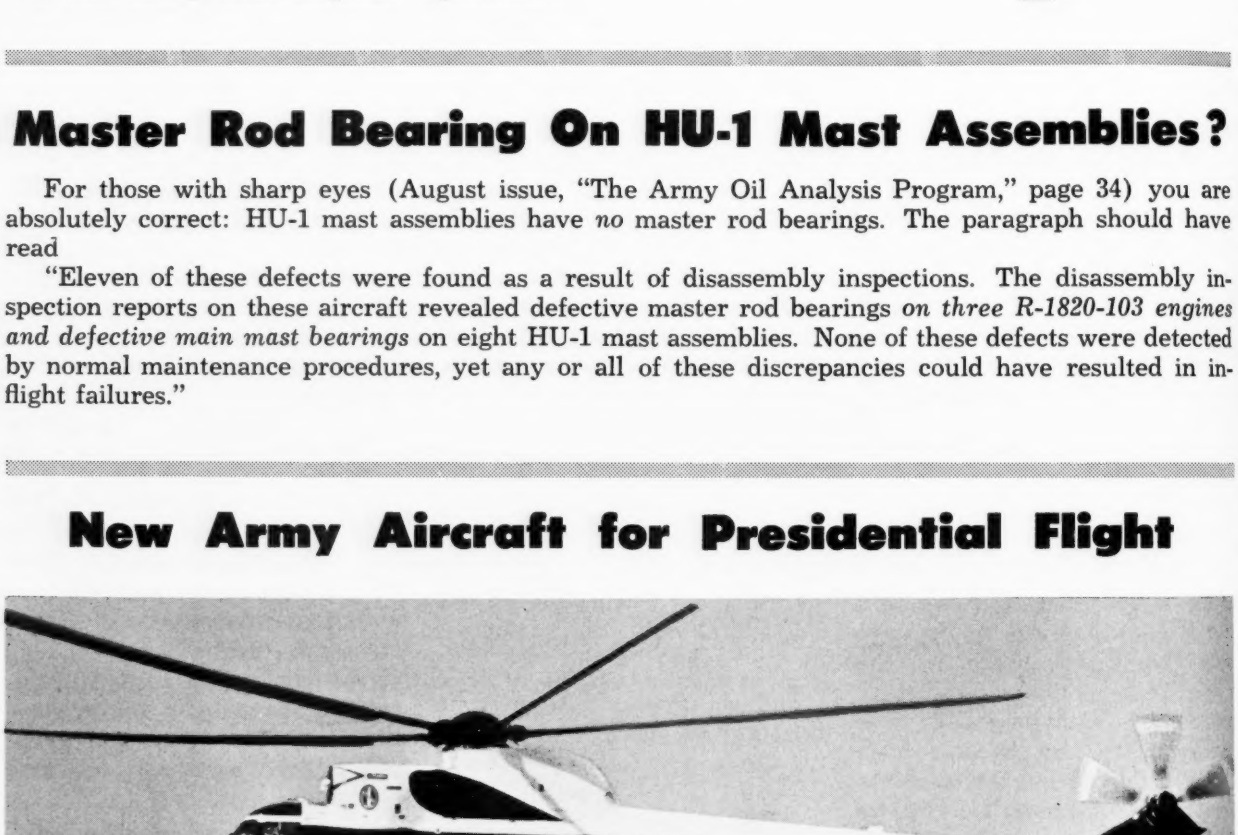
Although only theoretical examples have been given and results derived from them, I feel that helicopter airmobile raids of the future will be the means most used in the conduct of warfare. The helicopter with its many inherent advantages, to both planner and executor, offers greater flexibility and mobility than ever before possible. Readily responsive to the commanders will, its use will allow operations that have never before been considered possible.

Master Rod Bearing On HU-1 Mast Assemblies?

For those with sharp eyes (August issue, "The Army Oil Analysis Program," page 34) you are absolutely correct: HU-1 mast assemblies have *no* master rod bearings. The paragraph should have read

"Eleven of these defects were found as a result of disassembly inspections. The disassembly inspection reports on these aircraft revealed defective master rod bearings *on three R-1820-103 engines and defective main mast bearings* on eight HU-1 mast assemblies. None of these defects were detected by normal maintenance procedures, yet any or all of these discrepancies could have resulted in in-flight failures."

New Army Aircraft for Presidential Flight



Speed and flexibility for troop positioning, maximum control, and absolute surprise are the commander's weapons when he uses

Army Aviation
In Support Of
Counterguerrilla Operations

Captain William P. Griffin

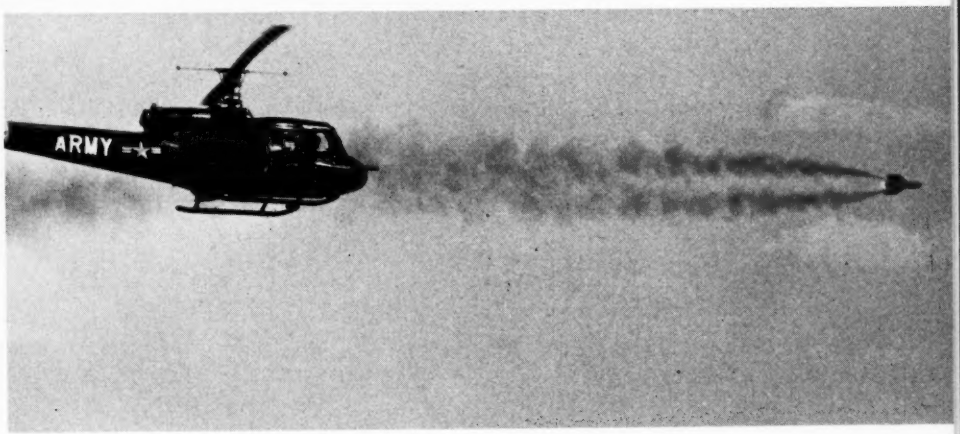
IT WAS THE FIRST light of morning when the men began moving around in a slow sleepy way after spending a very restless and uncomfortable night.

The leader sat in front of his brushwood lean-to and tried to think of ways to improve the position his band now occupied. Perhaps by studying the past methods used against the band by the Americans he could again gain the level of power he held not only over the guerrillas but also over those treacherous peasants who would no longer support him as they should.

The days of power and comfort were fine to recall, but ever since those accursed aircraft and helicopter soldiers had been encountered the troubles had multiplied. You couldn't stay in areas that were comfortable and furnished the necessities; you couldn't build a fire for fear one of the aircraft would spot it and bring down an armed patrol on you. Resupply from the party's aircraft was almost non-existent now that the Americans seemed to know exactly where the resupply would take place.

Whenever ambush is mentioned anymore, the men shudder as they recall the last fiasco. The area had been selected with great care and the men were

The copters on the ground took off and the one in the air unleased rockets and sprayed the position with machinegun fire



Capt Griffin is Asst Commander, Flight Standards Division, Dept Pri F/W Tng, USAAVNS, Ft Rucker, Ala. He is dual rated.

well hidden and ready to do their individual parts in the ambush. It was an unprotected supply convoy of ten vehicles. The leader had spotted the vehicles a half mile from the positions, when suddenly two helicopters had flown over and landed several troops at the small bridge that had been mined to trap the convoy. A third copter remained in the air.

One of the guerrillas had opened fire on the party while they were examining the bridge. It seemed as if this were the fuze necessary to produce the detonations that rocked the whole position. The copter on the ground took off and the one in the air unleashed rockets and sprayed the position with machinegun fire. Then the troops at the bridge began showering the area with light mortar fragments.

The men who were killed on position were the lucky ones because the wounded could not receive much help during the escape and subsequently had to be disposed of. Since then, the number of the band had been reduced by desertions, and even the harsh punishments meted out did not seem to stop it.

Earlier this morning helicopters had passed over the area. At that moment the earth rocked with the explosions of rockets and light mortars, small arms rounds whined and cracked through the camp. Those men standing near the edge of the clearing were cut down immediately and the others scrambled toward the edge of the thicket, attempting to escape. With confusion and panic all around him, the leader attempted to reorganize and lead the men near him in an escape, but the mortar rounds filling the area with jagged steel prevented anything but hugging the ground and trying to hide.

It seemed that the assault by a line of troops with bayonets took place before the explosions stopped, and the men who escaped in the swamps were few. The back-breaking blow to the guerrilla unit had been complete and the threat to this area would be almost nonexistent for quite a while.

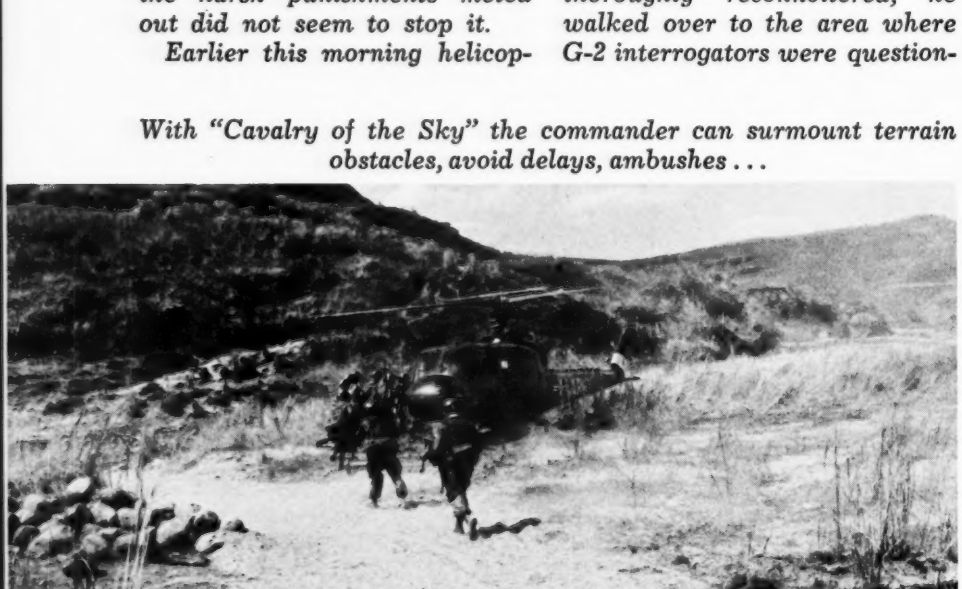
The company commander, U. S. Forces, was well pleased with the results of the raid. After organizing the troops into search parties and assigning areas to be thoroughly reconnoitered, he walked over to the area where G-2 interrogators were questioning the prisoners. The leader was promptly identified and air-transported back to Division for further interrogation, along with the radios, codes, and documents found in the area. This action was a series of successes for the Army commander using Army Aviation.

The band had been spotted by air-transported patrols investigating suspect areas and then confirmed by intelligence sources fringing the area. Maps and aerial photos had enabled the commander to devise a plan of landing that would place his troops in position to bring surprise, firepower, and shock into the guerrilla camp.

Although the guerrillas had warning nets to alert them of detachments moving on roads into their area, they could not possibly know the plans of this unit located over 100 kilometers away. Some helicopters had landed in clearings, while others hovered to let their troops off. Time between unloading and moving out to their objectives was measured in seconds. The raid had been completed successfully in an hour, and the troops were transported back to their unit ready for further commitments that same morning.

* * *

With "Cavalry of the Sky" the commander can surmount terrain obstacles, avoid delays, ambushes . . .



Today, when nations are conquered or liberated by unconventional forces, the Army must consider the potential aid or threat that these guerrilla units offer in an armed conflict. As a threat to our rear areas of operations they can divert strength, delay logistics, and cause battles to be lost.

The commander who must conduct operations in an area containing enemy guerrilla forces will find Army Aviation a most useful and swift weapon in his arsenal. With this "Cav-

alry of the Sky" he can surmount terrain obstacles, avoid delays and ambushes by minor forces, surprise the enemy within his encampment, and destroy him with a minimum force by swift and concentrated attacks.

The commander faced with the reduction or elimination of guerrilla forces will be primarily interested in successful action with an economy of force and time. A guerrilla force that suffers severe and qualitative type casualties will require much time before becoming effective again.

The maximum measure of success against guerrilla forces would be their complete annihilation. This, however, is virtually impossible without tremendous numbers of conventional troops and almost perfect intelligence. Minor successes such as raids, ambushes, and destruction of small supply centers may upset the guerrilla movement, but in the long run will not affect to a great extent the combat operations of well organized and well developed guerrilla forces.

The commander must assume the offensive. Defense of all areas will result in a poor defense for most, and presents the type target best suited to the guerrilla mode of operation. Army Aviation allows the commander to assume the offensive against guerrillas at some distance from critical areas and still be immediately available to those areas in the event of more critical needs.

Conventional forces cannot completely contain guerrilla movements because of their free movement and versatility in moving among the civilians in the area. Counterespionage is poor at best in areas where the civilian populace is hostile to the occupying powers or fearful of reprisals in the event of guerrila attacks. The commander can reduce guerrilla activity by increased intelligence, proper planning, and rapid movement into the area of decisive combat against the main force of the guerrilla band. The area will have to be in the sector of his largest grouping of personnel or main supply and training location.

The commander can reduce guerrilla activities by increased intelligence . . . rapid movement . . .

The guerrillas will attempt to control an area in which they have relative freedom of movement, excellent intelligence, safe supply areas, support of the civilian populace, terrain that favors the man on foot over the more modern conventionally equipped military, and an area that allows receipt of supplies from an outside friendly force.

This area will normally be in swamps, jungle, mountainous areas, or other difficult terrain. However, any area may be used by the guerrilla who is resourceful, imaginative, and possesses superior intelligence of the enemy.

The more active the counterguerrilla commander, the less active the guerrillas will be. The grouping of sufficient guerrilla force to accomplish worthwhile missions against conventional forces will be constantly disrupted and the mission delayed time and time again. A guerrilla movement must have victories with minimum casualties to ever attract enough recruits to become effective. The commander who causes heavy casualties to the band will cause the guerrilla to become cautious and possibly neutralize the movement.

An aggressive commander with a small, highly mobile force adequately informed will be far more successful than the commander who possesses a large force but uses them timidly and has ineffective intelligence.

In counterguerrilla warfare, the conventional units must accelerate and increase their means of acquiring information regarding the guerrillas. All methods that promise some success must be used, as well as all of the new innovations that can be tried.

Army Aviation can aid in collecting and gathering intelligence in many ways. Aerial photography, aerial monitoring and direction finding equipment, reconnaissance of suspected areas, and many other methods will aid in the location and destruction of unconventional forces.

Modern electronic detection

equipment has a use in counter-guerrilla warfare; however, due to the lack of motorized equipment and the natural evasiveness of guerrilla bands, large concentrations are normally avoided and concealed routes are used to avoid detection. These signal items can still be used in certain terrain and with certain groups. In spite of new advances in electronic gear, the man on foot traveling in difficult areas is fairly sure of escaping detection.

A guerrilla movement that does not have the aid of the local populace will expire in a short time. The band relies on the local civilian for recruitment, medical aid, intelligence, supplies, and many other aspects. All means of checking on the civilians must be used, as well as new techniques for controlling them.

Although the civilian populace may not fully support the guerrillas, they may aid them for fear of reprisals and loss of property. All means of protecting and training the local populace to resist the guerrillas and to recruit the people as information sources will have to be used.

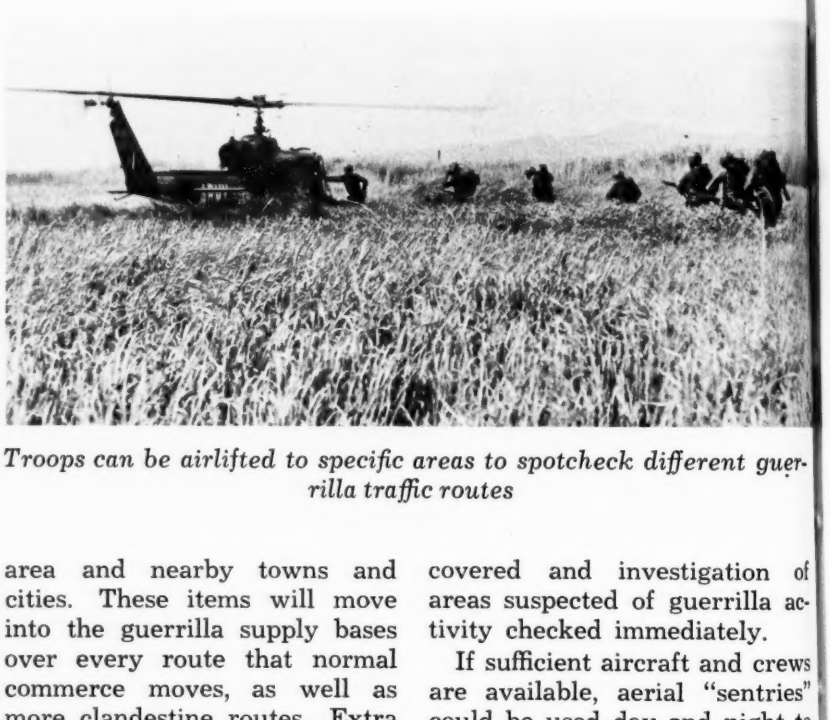
The establishment of paramilitary forces within an area would greatly impede the guerrilla's control and reduce their effect within the area. U. S. Army Special Forces to train, equip, and monitor these units would be available to many areas if transported by aircraft.

Since these areas would be a grave threat to a guerrilla movement, selected Reserve units would have to protect the area during a concentrated guerrilla attack. Centrally located Army units could constitute this force and be responsible for selecting several landing areas close to these militia units that could be used day or night. As new Army units come into the area, the commanders and staffs should constantly plan for the reinforcing mission to ensure effective relief of the militia and the destruction of the guerrillas. Marshalling and loading zones would be planned and SOPs formulated to ensure rapid dispatch of these troops.

A large guerrilla movement requires extensive supplies, and the area it occupied will not produce all of its needs. Although an outside power may furnish part of the war supplies, the essential items such as food, clothing and medicine, will have to be requisitioned from the local area and nearby towns and cities. These items will move into the guerrilla supply bases over every route that normal commerce moves, as well as more clandestine routes. Extra control on commerce will harass, delay, and limit the amount of supplies reaching the guerrillas.

Intelligence may learn the heartland of the guerrilla area by studying the movement of these items. The location of a resupply route could result in pinpointing caches and resupply areas of the guerrillas. Control teams of military police, native troops, and armed patrols selected from infantry units could be airlifted by helicopters to specific areas to spot-check different routes of traffic without warning the guerrillas. Those natives attempting to bypass the checkpoint could be spotted by aircraft orbiting near, and pursued by special squads either copter-borne or on foot.

Air-landed patrols could land at outlying villages and towns without warning and search these areas for supplies destined for use by guerrillas. Caches and supply points might be uncovered and investigation of areas suspected of guerrilla activity checked immediately.



Troops can be airlifted to specific areas to spotcheck different guerrilla traffic routes

If sufficient aircraft and crews are available, aerial "sentries" could be used day and night to watch for signs of DZs and LZs and bring destructive measures against the ground party. Although DZs and LZs will be hard to keep check on, only certain type terrain favors their selection. Careful study of maps would allow "sentries" to concentrate on areas most suited for this type operation. Guerrilla

activity that indicates an impending resupply may also alert an area and secure more specific information as to the DZ or LZ. Aircraft or helicopters on station nearby or on call could disrupt the ground party at the time of the drop.

Very few areas are so self-supporting that a large guerrilla band can do without bulk items. As a result, guerrillas will tend, at least in the early stages of their formation, to receive clandestine resupply close to their camps or cache areas. If weapon carrying or troop carrying aircraft are dispatched to the supply area immediately, the guerrilla will be forced to fight or lose those supplies. A ground party with their signal lights or radio equipment all set up to guide in the supply aircraft would be highly vulnerable to rocket or strafing attack by armed copters.

Although a drop might be observed but the action by attacking aircraft not swift enough, air-landed patrols and blocking positions could be set up around the area to stop the transport of supplies.

Well trained troops of team and squad strength, highly skilled in living off the land, with a knowledge of tracking or augmented by native trackers, specialists in patrolling, raids and ambush, could be airlifted into suspected areas for search, surveillance, performing raids and ambushes, pathfinding duties, and other counterguerrilla functions on a small scale. Their primary mission would be reconnaissance; however, they would be capable of defending themselves against a guerrilla enemy of disproportionate size due to their more modern equipment and military training. When these teams are combined into a larger unit or attached with a larger unit, such as a platoon or company, for a mission they could be augmented with special items of equipment.

Well trained troops . . . could be airlifted into suspected areas for search, surveillance, etc.

Personnel selected should possess either a natural background for this type operation or have previous training in Special Forces, Rangers, mountaineering, jungle training or survival schools. However, any division could train its own unit to suit the terrain by using cadre with special training.

This unit would be supported primarily for logistics, communications, and close-fire by Army Aviation and should be closely tied in with the aviation unit for training. The formation of this unit would best be accomplished at division level and under the control of the G-3.

In areas of strong guerrilla influence, convoys and troops should have armed helicopters either with the advance guard or in proximity so the armed copters may be immediately available to take under fire any ambushing or attacking guerrilla element. Thus, even though the guerrillas may secure the first surprise move by ambushing the column advance guard, the immediate retaliation by a vertical group would neutralize the effectiveness and possibly work to the advantage of the conventional forces. The ambush group, to be most effective, must present some mass and this would be an excellent target for the weapons of the armed copters.

Critical points along the march route could be checked in advance by either a two or three copter group preceding the convoy by 5 to 10 minutes.

In the event the guerrillas attack the convoy, the bulk of the armed copters are immediately called into action against the heaviest fires, and transport copters are ordered to land squads in blocking positions behind the ambush site to destroy the retreating guerrilla forces.

The immediate return of heavy fire from the copters and the vertical attack and envelopment by armed and transport copters would neutralize and discourage attacks of this type by guerrilla units.

Establishing of fire OPs along the route of march will be greatly facilitated by air-landed parties. A series of OPs selected in advance could be used to guard the route and quickly pinpoint trouble spots or danger areas to the column. For example, an

H-34 accompanied by another armed copter places a seven-man OP party on a hill mass overlooking a pass through which the convoy will have to move. Within the group there is radio communication to the indirect fire control within the column and an 81mm mortar with sufficient ammunition to disperse a small group. No FDC will be necessary for this mortar as the target becomes the aiming point and only range is computed. The party should be of sufficient size to engage an ambush unit but not so large as to create a target of itself.

Whenever the armed copters are used for this type mission, close coordination, prearranged signals, and all other means of communication must be used. All units down to platoon level must know of methods to ensure that the armed copters do not fire on friendly troops. This could be accomplished by colored smoke, panels, troop markings or any other definite visual signal that the copters could recognize. SOPs could be established within units if this type approach column was used frequently.

Any high fragmentary weapon would be most effective against the guerrilla element because of his dispositions in soft positions. The casualty not receiving excellent medical attention becomes a tremendous burden to the guerrillas, not only in the attack area but also when evacuated into the local guerrilla medical organization.

War against the mind of the guerrilla as well as against the body can be carried on by Psychological Warfare Teams, utilizing the mobility and versatility of Army aircraft. Broadcast from loud speakers carried in aircraft, leaflet distribution over wide areas, and all of the other mechanics of introducing our ideas to the guerrilla may be accomplished by aircraft.

If we as Army Aviators can recognize the three dimensional area of mobility that is now available to the commander, the speed and flexibility for positioning his troops for his attack, the maximum of control he will possess and the absolute surprise he can gain in counterguerrilla action, then we will be able to plan and advise competently the most economical and efficient ways of utilizing the Army's aircraft against one of the most potent dangers our Army will face—guerrilla warfare.

Hummingbird Flies

The Army's first turbojet VTOL airplane, the Lockheed VZ-10 Hummingbird, has made its first conventional flight.

After the test program to prove the aerodynamic and handling features of the Hummingbird in conventional flight, vertical takeoffs and landings will begin.

The chief engineering test pilot from Lockheed-Georgia said the first test flights were "completely successful in all respects" and reported the VZ-10 "handled exceptionally well."

The new craft has many of the flight characteristics of a real, live hummingbird. It will fly straight up, or down, hover, then dart like a flash at approximately 500 miles per hour.

The Hummingbird is a mid-wing monoplane, 32 feet long, with a wing span of 25 feet, powered by two Pratt & Whitney JT 12-A-3 turbojets.

Heart of the Hummingbird is a system of ejector mixing chambers buried in the fuselage. They are fed by high velocity exhaust diverted from its two jet engines mounted in pods on both sides of the fuselage. The mixing chambers are enclosed at top and bottom by bomb-bay type doors. For vertical takeoff, the flush doors are opened and free air is mixed with the exhaust gases and directed downward.

Once aloft, engine diverter valves and fuselage doors are closed. This directs the jet flow rearward for conventional flight.

Another first for Army Aviation — but not the kind that hits the headlines. This Army Aviator greased in on the belly of an L-23F. Here are his "before and after" comments.

Don't Forget to Smile

Major Frederick B. Weller

APPARENTLY I have the dubious, and I might add unwanted, distinction of being the first Army Aviator to have made a belly landing with the L-23F airplane. For what it is worth to the man who comes after me, here is what happened, what action I took, and what I would not do if I had to do the whole thing over again. (Yipe!)

I took off for a maintenance test flight and the gear retracted properly. However, when I came back to land 10 minutes later and dropped the gear handle into the down position, the left main gear indicator showed "in-transit" when the other two were down and locked. (Yes, the light in the gear handle was also on.) Knowing secretly that this was a simple malfunction of the microswitch in the wheel well, I casually dropped by the control tower for them to confirm that all three wheels appeared to be down and locked. I received my first coronary of the day when they casually informed me that the left gear was hung partially out of the well. I cycled the gear up electrically and engaging the hand pump (yes, I pulled the circuit breaker and put the gear handle into the down position), I cranked the gear until the nose and right main indicators showed "down." The left main still showed "in-transit," and another pass over the control tower confirmed the fact that it was still hung only halfway out of the well. As a last resort, I now mentally cranked the gear down twenty thousand times, but still the left main showed "in-transit." Then I realized that the moment of truth had arrived.

(For the benefit of the mechanically curious reader, the reason the left gear hung is that the torque tube leading out to the actuator separated from the universal joint in the wing root. It became separated because the clevis pin holding the two together dropped out. The clevis pin dropped out because the cotter key holding it in position dropped out. The reason the cotter key dropped out is something for the Board to figure out. In any case, the clevis pin fell out while the gear was being actuated into the down position and left the gear actuated only partially down while the inboard torque tube spun merrily around to the tune of the landing gear motor.)

I informed our tower personnel that I was proceeding to Sembach Air Force Base about 50 miles distant where they had an 8,000-foot runway, much crash equipment, doctors, plasma, APC pills, and clergy of all denominations. The operations officer at Sembach was informed of my predicament. Upon contacting me, he asked if I wanted foam laid out on the runway. I told him I would like that very

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Maj Weller was assigned to the aviation detachment, Hq USAREUR, when this article was written. He is dual rated.

much. So they foamed the runway. That is, they started about a thousand feet from what was to be my approach end and foamed a 2,000-foot section of it. This little caper took about an hour. Meanwhile, I cruised around the place, dangling my left gear at the thousands of onlookers who were thronging into the area in happy anticipation of viewing my coming battle with the runway.

I did put this hour to profitable use though. First I went upstairs to about 5,000 feet and "porpoised" the airplane in faint hope that something would give and the wheel would fall magically down and lock. It didn't. (I didn't know about the missing clevis pin yet.)

Then I went down and practiced traffic patterns. After making several approaches at different altitudes, I finally settled on 500 feet as being the proper height on the approach at which to cut all power. I was fortunate in having good weather for my act—no wind, smooth air, and good visibility. I guess it would have been nice to have a little headwind, but no wind was better than having one across the runway—or gusty. Also, while I made these practice approaches, I reviewed the procedure I was going to follow.

I was going to make a long, wide downwind leg at 1,000 feet. Just before I hit the base leg turn, I was going to cut the idle cutoff switch to the engine outboard to the turn, feather it, cut off its magneto switches and fuel, and then move the power of the other engine to 3000 rpm and whatever manifold pressure it took to hold 110 knots. I would then turn into the good engine on base leg, beginning my descent in the turn and stopping at 500 feet. While I was in this turn, I would check the dead prop to make certain I had one blade straight up. If it wasn't, I would move it around to that position by punching the start button.

Turning onto the approach, I would check my airspeed for 110 knots and hold 500 feet of altitude until I reached the point where I had decided that I would feather the other engine. At this point, I would have my right hand crossed over in front of me and on the left fuel tank selector handle. I would quickly turn the handle to "off," thinking that would be one more cleanup step out of the way with no sudden letup in engine performance—a development which could rattle the pilot—me.

Then, smiling coolly, I would reach back across in front of me, cut the mixture to that engine, throttle it back and quickly feather it. I would then cut off everything else that I could lay my hands on and let the aircraft glide downwards at 110 knots—along with a grim smile—until I was very low over the first third of the runway. At that point I would smile hysterically and level the aircraft.

From then on, I flat didn't know what was going to happen. I only hoped that it would not be something which would cause me to think ruefully about not carrying flight pay insurance.

The foam trucks finally cleared the runway and the people in the tower gave me the nod to give it the old college try. So I did just like I said I was going to do. On the downwind leg I cut the idle cutoff switch to the engine outboard to the base leg turn, feathered it and cut off its magneto and fuel switches. I set the other prop to 3000 rpm and power to about 40 inches, and then turned onto base leg into that good engine. Then I punched the start button—and nothing happened! Immediate flap in cockpit—sudden brainstorm—turn start selector switch to dead engine so that start button works—action—start button then pushed and prop centered so that bottom two blades are angled away from bottom center—end of flap in cockpit.

On base leg I judiciously manipulated the throttle to hold 110 knots and lose 500 feet. I turned onto the approach 2 miles out and held altitude and airspeed. At about a quarter-mile from the end of the runway I reached across and cut the fuel to the good engine. Then I cut its mixture, feathered it, and waited apprehensively for a fast sink rate which would put me down short of the runway.

It didn't happen.

The nose dropped to what looked like a normal 500 fpm descent attitude. With me still holding 110 knots, the airplane glided gently—and noiselessly—towards the runway. I passed over the end of it at about 300 feet, and, as I neared the foamed area a thousand feet down the road, I shallowed the glide out a bit in anticipation of a level touchdown in the foam.

Well, I glided. *I glided over the beginning of the foamed area, past the center, and I was still gliding when I passed low over the other end of it.* By then I was in an almost level attitude about 15 feet from the ground—and still gliding. I felt the hung gear touch and a second later give way. I leveled the aircraft and glided some more. The wheels touched the runway and I rolled silently along for about a thousand feet. I had not yet touched the brakes but I moved my feet up on the pedals so that I could toe them quickly if I had to.

I was still holding the aircraft

level, but I could feel it start to bob a little. This may have been due to the unevenness of the runway or my subconscious testing of brakes as some ominous white lines ahead of me on the runway entered my upper periphery of vision. As the aircraft bobbed slightly forward, I heard what I assumed to be the two bottom prop blades ticking the runway. (I was right. They were.)

I was now making a serious application of brakes. As they took effect and the airplane lost speed, the nose came up and I heard the underside of the fuselage contact the runway. It scraped for about a hundred yards before the airplane stopped with the nose in the air and resting on the two main wheels and fuselage section under the cabin door. I had another scant hundred yards of runway left in front of me. Use it all, I always say. Start from the other end, though.

I exited the aircraft to the deafening cheers of the millions of people who were running towards me. (Twenty-five personnel, including a group of firemen who were obviously thinking dark and uncharitable thoughts about the one hour of labor and 8,000 gallons of foam lying unused on the runway.) Examination of the airplane showed erosion to the tips of two prop blades on both engines; erosion to two panels on the underside of the fuselage; and that the left gear actuator, mount and outboard torque tube bent and jammed when the gear gave away on touchdown.

Air Force mechanics raised the airplane through the use of air bags placed under the wings and then slid jacks under it. The main and nose gear were pumped down and the left gear was disconnected from its actuator at the drag brace. The drag brace was wired at the knee and I taxied the airplane to the ramp. Two days later the props had been changed by our own mechanics and it was flown to an army airfield for sheet metal work, a new actuator and new torque tube.

And now, what I consider as two big errors on my part in making this landing:

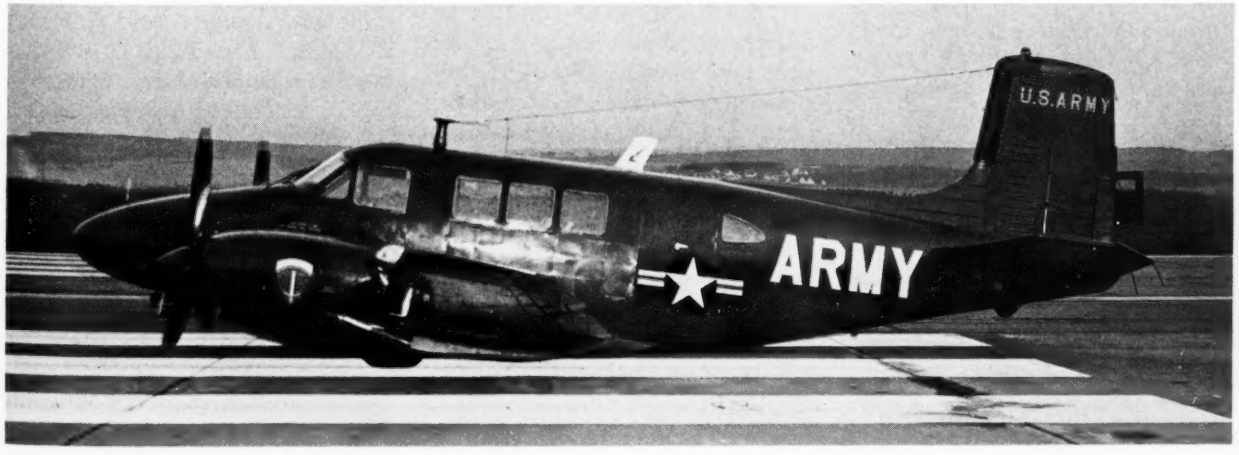
First, I was totally unprepared for the terrific glide ratio which the L-23F airplane has when it is clean—with flaps and wheels up and engines feathered. I mean—and man, I really mean this—that airplane goes a long way at 110 knots and no outside drag. Consequently, in this instance, I was too close to the end of the runway when I feathered the second engine, and I wound up using the far end of it instead of the near end. I say "in this instance" because in another instance, say in a strong headwind, I might have hit it just right. However, and also in another instance, I could have been heading for a short runway, and man—well, like there was a big dropoff on that far end!

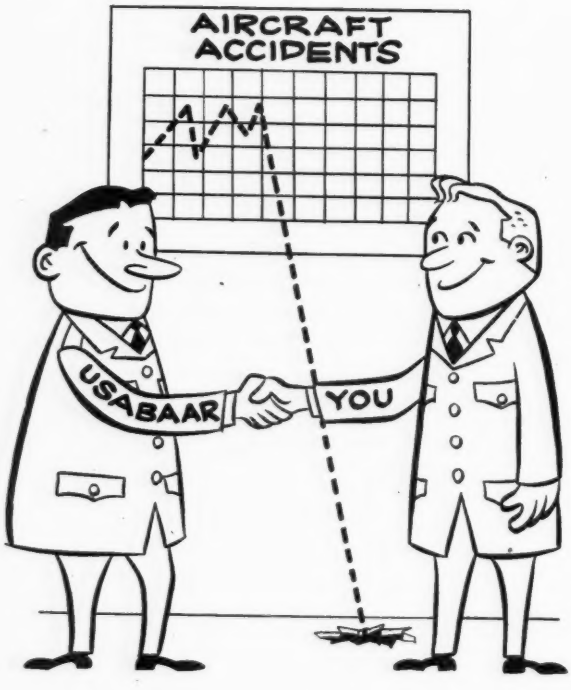
The point is that when the second engine is feathered, your glide angle to the ground is going to be much shallower than what you expect in order to hold whatever airspeed you have set up. I held 110 knots, and the shallowness of a 110-knot glide with a cleaned up airplane was a very pleasant surprise to me, even if I did miss the foam.

Frankly, if I had to do it over again, I would start the glide at 110 knots and 500 feet, but farther back. The 110 knots is an almost necessary minimum to start with because you have only one fan working to hold altitude. You would find yourself hard pressed with anything less than that in, say, a doubtful or gusty wind. So, at 110 knots,

Continued on page 48

The plane stopped . . . nose in air . . . resting on main wheels and fuselage section under cabin door





USABAAR *and YOUR Accident Prevention Program*

Lieutenant Colonel Orval H. Sheppard

RECENT COMMENTS and questions indicate that some Army personnel are not familiar with the United States Army Board for Aviation Accident Research and the role USABAAR plays in the accident prevention program—*YOUR* accident prevention program.

This will be a brief explanation of what USABAAR is and how it operates to help YOU prevent aircraft accidents. Brigadier General Delk M. Oden, Director of Army Aviation, defined our mutual goal with this philosophy:

"Our accident prevention program must not restrict the basic role of organic aviation. We dare not inhibit our operations by unwarranted or arbitrary regulations. We must concentrate our efforts toward positive means of raising our professional standards and increasing our combat capabilities. Our objective is twofold — to reduce aviation accidents to zero, while allowing the aggressive accomplishment of our mission."

WHAT IS USABAAR?

USABAAR is a class II activity of the Deputy Chief of Staff for Military Operations. As outlined in AR 15-76, the mission of USABAAR is to conduct research of aviation accident experience, particularly Army experience, in order to determine personnel or materiel deficiencies in Army Aviation which result in noncombat loss. Based on analyses of this research, the Director of USABAAR is required to recommend to the Director of Army Aviation appropriate action to enhance the durability, reliability, and efficiency of Army Aviation. The activities of USABAAR do not conflict with those of safety directors at any given echelon of command. The Army safety program and USABAAR share common objectives.

To accomplish its mission in the most effective manner, USABAAR is divided into five major divisions. These are the Administrative Division, Investigation Division, Education and Literature Division, Liaison Division, and Analysis and Research Division. The A&R Division is further divided into Automatic Data Processing, Operations and Training, Engineering, and Human Factors sections.

The Administrative Division performs administrative, supply, and fiscal requirements essential to the operation of the organization.

Col Sheppard is Director, United States Army Board for Aviation Accident Research.

INVESTIGATION DIVISION

Aviation accident research is completely dependent on thorough accident investigations and accurate reporting. The Investigation Division conducts investigations of Army aircraft accidents of unusual significance. An accident of unusual significance is one in which (1) the aerodynamical behavior of the aircraft is such that there is no known precedence, or (2) the cause factors may confirm previously suspected but unconfirmed causes, or (3) unusual public interest may be aroused, or (4) information may be gained which would contribute to special studies in aviation safety. Teams from this division are immediately available for investigation assistance to commanders of major commands, Chief, National Guard Bureau, and commanders of class II installations.

The value of thorough and complete aircraft accident investigations cannot be overstressed in building an effective accident prevention program. Army aircraft accident investigations have improved rapidly as graduates of the U. S. Army Aviation Safety Course at the University of Southern California have taken their places in Army units around the world. DA Pamphlet 95-5, "Handbook for Aircraft Accident Investigators," has also contributed to the improved quality of accident investigations. The first revision of this pamphlet was published 1 October 1961.

The Investigation Division works closely with the Education and Literature Division in promulgating and disseminating a continuous education program designed to improve the quality of Army-wide aircraft accident investigations.

LIAISON DIVISION

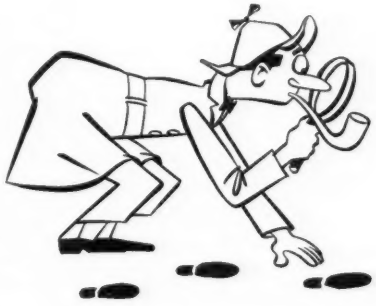
USABAAR maintains contact with other similar military and civil agencies. Certain areas of similarity between the flying of the other services and civil aviation make close liaison with these agencies a valuable source of accident prevention information.

One Army representative is stationed with the U. S. Air Force Directorate of Flight Safety, Norton Air Force Base, Calif. Another representative is stationed with the U. S. Naval

Aviation Safety Center, Norfolk, Va. These officers collect, evaluate, and exchange information.

The Army representative stationed with DFS monitors the Army Aviation Safety Course at the University of Southern California. He reviews the curricula, supplies instructors with USABAAR Education and Literature Division material, and provides administrative support for students. This 10-week course is devoted to training officers in aircraft accident investigation techniques and accident prevention.

USABAAR officers also participate in contractors' technical mockup inspections, conduct special studies of accident prevention programs, and keep up-to-date on the activities of other agencies.

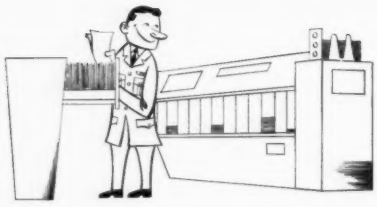


ANALYSIS AND RESEARCH DIVISION

The Analysis and Research Division is the heart of USABAAR. Here, reports of all Army aircraft accidents are gathered, reviewed, coded, and microfilmed for permanent record.

Through analysis, the A&R Division determines trends and accident potentials in the areas of operations, maintenance, weather, medical, supervision, training, personal equipment, and materiel. Isolating cause factors in these various fields, the division provides recommendations for improvements.

Because of the widespread range and complexity of aircraft and supporting equipment, specialization is required to assure adequate analyses of accident producing problems. For this reason, the A&R Division is divided into four sections:



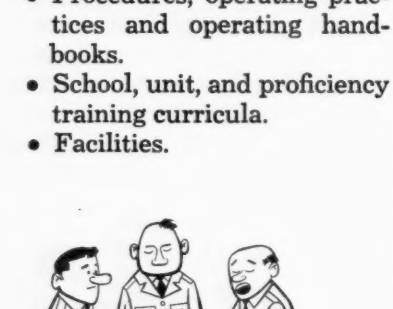
AUTOMATIC DATA PROCESSING SECTION

The Automatic Data Processing Section serves the other divisions and sections of USABAAR by providing machine data processing and analyses of aircraft accident experience. This section also prepares required statistical reports.

OPERATIONS AND TRAINING SECTION

The Operations and Training Section analyzes aircraft accident experience to determine where improvements can be made in:

- Procedures, operating practices and operating handbooks.
- School, unit, and proficiency training curricula.
- Facilities.



ENGINEERING SECTION

The Engineering Section analyzes aerodynamical, structural, systems and propulsion factors in aircraft accidents. From this, it develops the most productive areas for actions by appropriate agencies to improve the durability and reliability of Army aircraft.

Paragraph 28 of DA Pamphlet 95-5 outlines the procedure for laboratory analyses of failed and suspect parts. When requests for such analyses are received, the Engineering Section determines their validity. If analyses appear justified, this section coordinates with Transportation Materiel Command to provide shipping instructions to the appropriate facility.

HUMAN FACTORS SECTION

The Human Factors Section analyzes physiological and psychological factors in aircraft accidents to determine their influence on crew performance. From this, it develops recommendations for actions to be taken to reduce human error in Army Aviation.

The Human Factors Section also analyzes crash injuries to determine, in survivable accidents, how injuries were incurred or averted. From this, it develops recommendations for actions to be taken to delethalize Army aircraft in those accidents in which deceleration forces are within human tolerable limits.

EDUCATION AND LITERATURE DIVISION

The Education and Literature Division is the voice of USABAAR. From information supplied by the other divisions and sections, it prepares aviation safety information and education material for Army-wide distribution. Among the items prepared by this division are statistical studies, aircraft accident prevention surveys, short talks for aviation safety officers, and accident investigation information.

Sixteen pages of the U. S. ARMY AVIATION DIGEST are reserved for USABAAR material each month. The Education and Literature Division uses this space to publish *Crash Sense*, *TWX Excerpts*, and articles of seasonal and topical interest.

The Education and Literature Division acts as project agency for films on accident investigation and prevention. It supplies information to contract firms for publication of accident prevention material and edits the material before publication. Among these are Sense Pamphlets and Flight Safety Foundation General Aviation Safety Exchange Bulletins.

CAN USABAAR HELP YOU?

After reading this, you may have questions that weren't answered in this brief description. Or you may want additional copies of a publication, or accident briefs and photographs to use in your prevention program. Perhaps you have an idea about how to improve the accident prevention program. If so, we'd like to hear from you. Please address your queries, comments, and suggestions to: Director, USABAAR, Fort Rucker, Ala. Better yet, call us through the Ozark, Ala., exchange. Our number is 774-5131, extension 3410. Direct communication is authorized by AR 15-76.

Lt P. O. Elle Learns About Standardized Fuel

Major Joseph A. Gappa, Jr., and SFC Wayne C. Goins

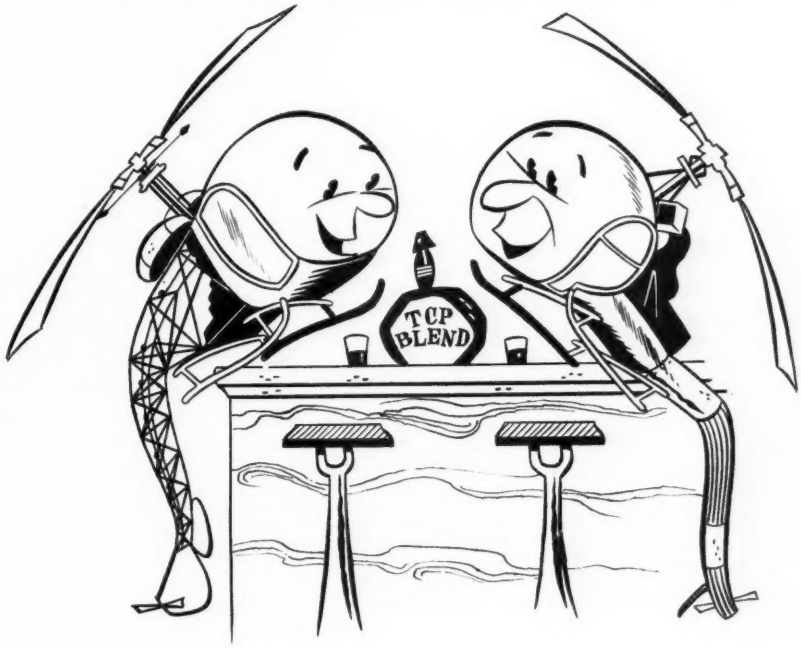
"WHAT'S WITH this fuel standardization program?"

"Lt P. O. Elle, on 1 July of this year the Army took a giant step forward in standardizing fuels for Army aircraft. If you'd been around in past years, you'd have lived through an era of red, blue, green, and purple fuels with octane and performance ratings all the way from 80 to 145, not to mention JP-4. The standardization program initiated 1 July in CONUS is designed to simplify this complicated spectrum and eliminate confusion."

"Seems to me you've mastered past points of confusion only to be confronted by a completely new set of rules. How can that help standardization?"

"From now on, all aviation fuels for reciprocating engines will be replaced with one fuel: 115/145. No more colored charts. No more markings. And no more homemade devices to keep fuels straight. What could be simpler?

"But there is one hooker. Tests conducted by USATATSA about a year ago showed that 0-435 and 0-335 engines must have TCP added to their fuel. These engines are in H-13 and H-23 aircraft. All other engines have been placed on a selective basis. This means that TCP will be



Maj Gappa is Chief, Engineering Section, USABAAR. SFC Goins is a technical inspector in the section.

added as deemed necessary at the user level. One determining factor is spark plug fouling. When plug fouling is suspected or observed due to fuel, TCP should be added. Another determining factor is logistical. If bulk mixing of TCP is most feasible, TCP may be used at all times."

"How do you determine what is the most feasible?"

"Existing conditions in each situation must be evaluated locally. In other words, considerable leeway is being given. For example, if all fuel is delivered to aircraft by fuel tankers, it may be most feasible to mix TCP in each fuel tanker and use only fuel mixed with TCP in all aircraft with recip engines."

"How is TCP mixed locally?"

"TCP is mixed in accordance with TB AVN 23-2 at the user level. Responsibility for accomplishing this rests with the local commander. Trucks and tanks issuing or storing fuel with TCP will be marked by stenciling 'TCP' in 1½ inch letters on the lower right-hand corner of the sign used to identify the product."

"What harmful effects, if any, may arise from using TCP in all engines?"

"No harmful effects will come from using fuels with TCP when the engine does not need TCP to prevent plug fouling in recip engines. TWX: TCMAC-EHU-1 05-01374 gives details of AVGAS used for emergency fuels in turbine engines. One point of this message should be emphasized: AVGAS with TCP added should *NOT* be used as an emergency fuel in turbine engines.

"Won't this standard fuel introduce special maintenance problems?"

"It is anticipated that only the 0-470 engine (L-19) using 115/-145 fuel, with or without TCP, will have any special problems. This will involve a reduction in the TBO (time between overhaul) of the 0-470 engine from 1200 to 700 hours if the engine is operated with the new fuel for the full 700 hours. During the changeover period, a graduated TBO replacement schedule will be in effect. (References listed at the end of this article outline this schedule.)

"For example, if a certain engine had been operated on 80/87 AVGAS for 300 hours, then switched to 115/145, it would be removed at 1000 hours; if operated for 600 hours on 80/87 AVGAS, then changed over to 115/145, it would be removed at 1200 hours. All engines removed for overhaul must be accompanied by records reflecting the number of hours of operation on 115/145 fuel."

"Why is the 0-470 engine the only one affected and will this condition ever be corrected?"

"Tests run by USATATSA, Fort Rucker, Ala., on this engine with 115/145 fuel showed that the valves were affected as were other lesser parts of the engine. On the next overhaul, following initiation of the fuel standardization program, these parts will be replaced with improved items and it is anticipated that TBO will again improve."

"Suppose an Army aircraft is refueled at a civilian field with other than 115/145 fuel with or without TCP?"

"For a short period of operation, this is an acceptable practice."

"Are there any other points of interest associated with the fuel standardization program?"

"One item may be added. When AVGAS 115/145 is used, engine operating limits remain the same as indicated in the flight manual. In all cases, the idle mixture and rpm must be correctly set. Overseas commanders, under this standardization program, have reported no difficulties."

"What is TCP?"

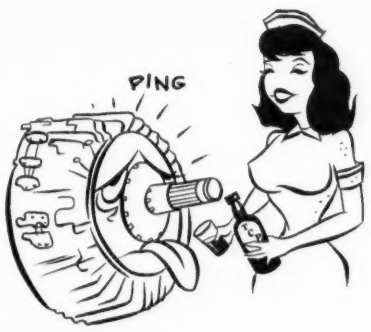
"TCP, or trecresyl phosphate, is a chemical used with high leaded fuels. It improves spark plug life and reduces plug fouling.

"Lead deposits in engine com-

bustion chambers can 'short out' spark plug electrodes, resulting in misfires. They can also cause pre-ignition by continuing to glow after combustion.

"TCP does not prevent formation of lead deposits. But it does alter the electrical resistance characteristics and temperature resistance to a point where the effect of spark plug fouling and pre-ignition is minimized. Lead deposits may be found in cylinders of engines in which the fuel additive has been used. The presence of lead deposits does not indicate that the additive is not accomplishing its purpose, but it may indicate that excessive carbonaceous deposits are interfering with the remedial action of the fuel additive.

"TCP will do little or no good for an engine already leaded up from the use of untreated fuels. Before using TCP in fuels, the spark plugs should be removed and cleaned or replaced, and plug wells should be cleaned and lead deposits removed. Lead deposits cause piston, valve and combustion chamber burning.



"Engines that have been operated with TCP treated fuels may, for short periods, be operated with untreated fuels in emergency conditions. However, before again using treated fuel, all spark plugs should be removed and cleaned or replaced and plug wells cleaned of all lead deposits.

"TCP treated fuel may be used in all reciprocating engines with high lead content fuel. It is not a cure for all engine troubles, but—used in the correct proportions, as outlined in TB AVN 23-2—and added to clean dry fuel will greatly reduce spark plug fouling, engine burning and wear due to lead deposits. All this adds up to better engine and spark plug life and trouble-free operation.

"TB AVN 23-2 outlines instructions for proper bulk mixing of TCP with fuel. The same reference further cautions one of the toxic effects of TCP. Read TB AVN 23-2 *before* working with TCP."

"This has answered my questions on standardization. If any others come up, where could I get an answer?"

"Lt P. O. Elle, these references should answer all your questions and should be studied carefully for a thorough understanding of the program:

TB AVN 23-2
TB AVN 2
TMC MSG #TCMAC-EM 05-02168
TMC MSG #TCMAC-EHU-1-05-01374
TMC MSG #TCMAC-EM-06-00025

"If this doesn't do it for you, write to: Director, USABAAR, Fort Rucker, Ala., or call 774-5131, Ozark, Ala., extension 3913 or 4198 and outline your problem. You'll get an answer."

MAINTENANCE CORNER

Presented here are some of the errors of torqueing uncovered by a recent study:

1. Frequently, fasteners that have been over-torqued have then been "backed-off" and re-torqued to the proper values.

2. Motor-driven impact wrenches with capacities higher than the desired torque values have been used in preliminary tightening.

3. Many torque handles are misused as hammers, crowbars, and doorstops. Others are not thoroughly inspected and recalibrated after they have been dropped or banged about.

4. Some forget to inspect torque handles periodically and calibrate them in accordance with pertinent tech publications. And too often they are not readily available to maintenance personnel.

5. A common error is failure to lubricate before insertion and there have been numerous cases of fittings being installed with damaged threads and other defects.

6. Wrenches other than torque handles have been frequently used to torque threaded fasteners that have assigned torque values.

7. Extensions are sometimes used on the drive ends of torque handles. This gives a false reading.

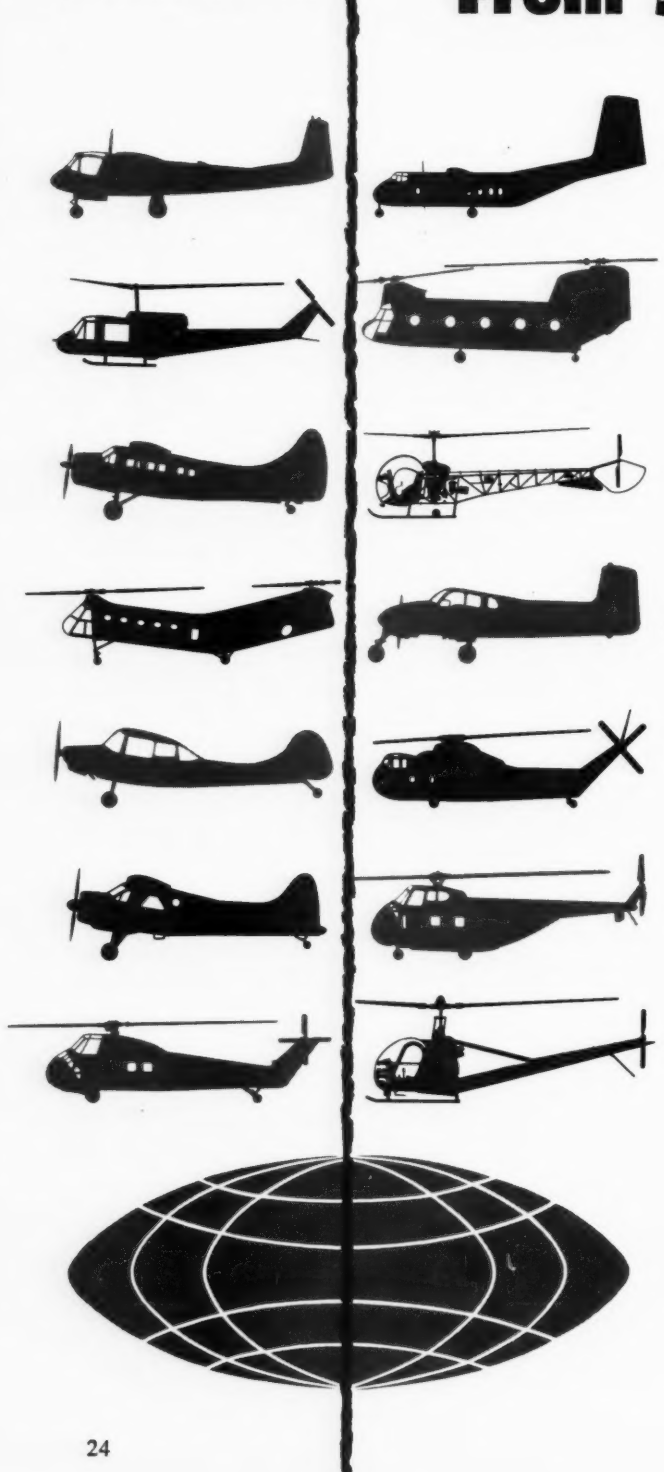
8. Clevises have been fitted by over-torqueing of the clevis parts.

—Flight Safety Bulletin

prepared by
THE U. S. ARMY
BOARD FOR
AVIATION
ACCIDENT RESEARCH

TWX EXCERPTS

From July and August



HU-1B LOST POWER and exhaust temperature rose to 650° in flight. Aircraft completed forced landing with no damage. Suspect governor and fuel control failure.

U-1A ENGINE RAN ROUGH and oil covered windshield shortly after takeoff. Aircraft completed forced landing with no damage. Caused by materiel failure of exhaust ear of No. 2 cylinder.

HU-1 ENGINE FAILED shortly after takeoff at approximately 150 feet. Aircraft landed in lake, pitched forward, and came to rest on left side in 8 feet of water. Major damage to rotor system and tail boom. Copilot and two passengers sustained minor injuries. Cause of engine failure undetermined pending investigation.

AC-1 STRUCK DITCH at end of landing roll, causing major damage to nose gear and nose section. No injuries. Ditch, 11 feet deep, was covered by tall grass and weeds.

H-13H STRUCK WIRE while low flying over river. Aircraft crashed in descending left turn in 2 feet of water. Aircraft destroyed. Pilot sustained minor abrasions and bruises.

H-13H EXHAUSTED FUEL in flight. Incident damage to right skid during forced landing. No injuries. No malfunction suspected.

AC-1 LANDED LONG and rolled under wires. Upper portion of vertical stabilizer and rudder section severed. Suspect aircraft landed downwind.

H-37B ENGINE BACKFIRED in flight, causing screening and cowling of induction system to blow off. Aircraft completed forced landing with no damage. Caused by materiel failure of valve in No. 1 cylinder of No. 1 engine.

HU-1A ENGINE FAILED at approximately 1,500 feet. Aircraft fell through and landed hard during autorotative forced landing. Tail boom severed. Major damage to undercarriage and rotor blades. No injuries. Suspect fuel contamination.

L-19E STRUCK WIRE during low reconnaissance. Incident damage to propeller and wing. No injuries.

H-21C MANUAL ENGAGING TOOL slipped into jaw position prematurely during attempt to engage clutch manually, causing incident damage to forward rotor blade. No injuries.

H-19D LOST OIL PRESSURE in flight. Aircraft completed forced landing with no damage. Caused by broken oil line.

L-20A TAXIED INTO concrete abutment, causing incident damage to right main tire and propeller. Gusty surface wind considered a factor.

L-20A TAXIED INTO taxiway marker, causing incident damage to propeller.

H-13H TAIL ROTOR BLADE damaged when improperly secured canvas panels blew up while aircraft was completing approach to confined area. No injuries.

H-13G ROLLED OVER and burned during practice slope landing. Whip antenna was struck by main rotor blade while right skid was upslope and deflected into tail rotor, wrapping around tail rotor hub and causing tail rotor drive shaft to break. Aircraft went out of control and tipped over. Aircraft destroyed. No injuries.

L-19A TAXIED INTO obstruction light, causing incident damage to elevator.

AO-1 HYDRAULIC FAILURE occurred in flight. Landing gear lowered with emergency procedures and aircraft completed forced landing with no damage. Caused by hydraulic leak at flange connection.

H-34A ENGINE FAILED during night training flight. Aircraft completed forced landing with no damage. Engine failure caused by stripped magneto gear.

L-20 ENGINE RAN ROUGH and backfired in flight. Aircraft completed forced landing with no damage. Caused by materiel failure of push rod on exhaust valve in No. 2 cylinder.

H-34A TAXIED INTO parked H-34 while backing. Major damage to main rotor blades of taxiing aircraft and tail rotor of parked aircraft. No injuries.

L-19 STRUCK WIRE during landing approach. Incident damage to windshield. No injuries.

H-23B STRUCK TREES while hovering in confined area. Major damage to main rotor blades. No injuries.

L-19A STRUCK WIRE during recovery from simulated forced landing. Incident damage to propeller. No injuries.

H-34A STRUCK OVERHEAD fuel tank while taxiing to refueling point. Fuel ignited, causing heat damage to right side of aircraft. Major damage to main rotor blades and severe stress on power train. Crewman directing taxiing aircraft from ground sustained minor injuries.

H-34 CAUGHT FIRE when microswitch in fuel selector valve shorted and started burning in flight. The fire was extinguished and the aircraft landed without further incident. Caused by electrical short. No injuries.

U-1A LANDED HARD, buckling fuselage and damaging tail wheel bracket. Weather not a factor. No injuries.

L-19E STRUCK TREE during approach to tactical strip. Incident damage to left wing. No injuries.

H-37B SETTLED AND CRASHED during low reconnaissance for mountain landing site. Major damage. No injuries. Downdraft considered probable factor.

H-19D ENTERED ground resonance during taxiing turn. Incident damage to whip antenna and tail rotor blades. Battery broke loose, causing holes in fuselage. No injuries.

AC-1 CAUGHT FIRE during oxygen servicing operation. Flash appeared when filler valve was opened. Incident damage to oxygen filler valve and gauge. Static electricity probable cause. No injuries.

H-13E STRUCK TREES during low-level flight. Incident damage to main rotor blades. No injuries.

L-20A CRASHED INTO TREES during attempt to miss aircraft at far end of strip while going around. Go-around caused by loss of directional control due to tail wheel striking rut at touchdown. Major damage to aircraft. No injuries.

H-23B EXHAUSTED FUEL in flight. Aircraft completed forced landing with no damage. No malfunction suspected. Weather not a factor.

H-13G TAIL ROTOR BLADE FAILED at approximately 200 feet after takeoff. Out of balance condition caused by loss of tail rotor blade resulted in tail rotor gear box separating from aircraft. Aircraft descended in nose-low spiral and landed hard, causing extensive damage to airframe and rotor systems. No injuries.

H-34C LOST POWER during climb after power recovery from practice autorotation. Aircraft completed forced landing with no damage. Caused by materiel failure of No. 8 cylinder.

ELECTRONIC TREETOP FLYING

William H. Smith

TREETOP FLYING, where the aviator is following the contours of the terrain, over or around hills and high trees and down through gullies, is an accepted technique in Army Aviation today; but every aviator will tell you that certain problems and disadvantages to this type of flying limit its use.

One is the matter of endurance. In high altitudes, the aviator can be expected to fly for 6 or 7 hours a day. But in low-level flying where a high degree of concentration and reflex action is necessary, this endurance time may be reduced by at least 50 percent.

Another problem is the matter of navigation. To do this type of flying properly, an aviator should study recent aerial photos and maps and plot courses with distances included. A good planning figure is 2 hours preflight planning for each flying hour. The urgency of the mission cannot always wait this long. And there is disorientation. Normally used check-points can be missed by being 200 or 300 yards off a desired flight path; also their relationship to other objects is not always apparent.

Finally, there is the problem of observation. The speed the aircraft is flying is much more obvious at low levels than at high altitudes. The aviator must make split second recognition of targets, but at times the terrain is so rough and hazardous that he can't afford one small peek at the ground below him. These major problems have plagued low-level flying since its inception. Up to now there has been

no solution.

Recently a new electronic flight system has been developed (AN/ASA-18 Terrain Clearance Adapter) that may end all of these objections in one sweep. With little or no assist from the aviator, this system will guide low flying airplanes over surface obstacles, leaving the aviator free to make ground observations or to perform other duties as needed. Furthermore, it is only necessary to tell the system the direction to go, and no long, detailed study of the terrain is needed. Also, it is conceivable that the same system might be used to assist in foul weather landings and takeoffs.

There are two approaches to any low-level navigation system. One is terrain following (fig. 1). In this the aircraft is not allowed to go around an obstacle but is kept on its path, flying over mountain ranges, tall buildings, etc. The other system is terrain avoidance (fig. 2). In this, the aircraft is sent around obstacles or through saddles, etc.

Both of these have their advantages and, of course, disadvantages. A combination of both systems is best. Such a combined system consists of a forward-looking radar, an absolute altimeter, a radar readout, and an analog computer which provides either a display or direct control of the aircraft through an autopilot.

To be satisfactory for Army use the system is required to have high resolution, short frame time, and an easily interpreted alarm display. High resolution is necessary to recognize the terrain objectives in the search sector. A short frame time is necessary to update the information quickly to allow maximum aircraft operation decision time.

One system already developed uses a shadow analysis technique along with a continuous monitoring of the absolute altimeter to warn of obstacles in the aircraft's flight path and to facilitate selection of safe headings when obstacles cannot be cleared by increasing altitude.

Designed primarily as an adapter, the system can be used with a mapping or weather radar already installed in an aircraft. When it is either unfeasible or undesirable to use an existing radar, the system can be furnished completely.

Information relative to the existence of terrain obstacles in the aircraft's flight path is displayed on the system's pilot's indicator (fig. 3). Simultaneously, alternate flight path is displayed on the PPI scope and, when appropriate, warning devices are activated automatically.

When adapted for use in drones, the system provides for proportional control integrated with the automatic flight control system. Design of the autopilot coupler assures the maximum control possible consistent with the ability of the vehicle to engage in low-level flight without ground contact. It provides greater ability to conform to the terrain profile than is possible by other means, even with extensive preflight programming.

Figure 3. Pilot's indicator

Other systems are already developed or in the process of being developed. All are being tested. But it is now evident that an electronic system which can eliminate the problems encountered in ground hugging operations may soon be available. The requirement now is to find the most suitable equipment that can be applied to this technique.

Figure 1. Terrain following

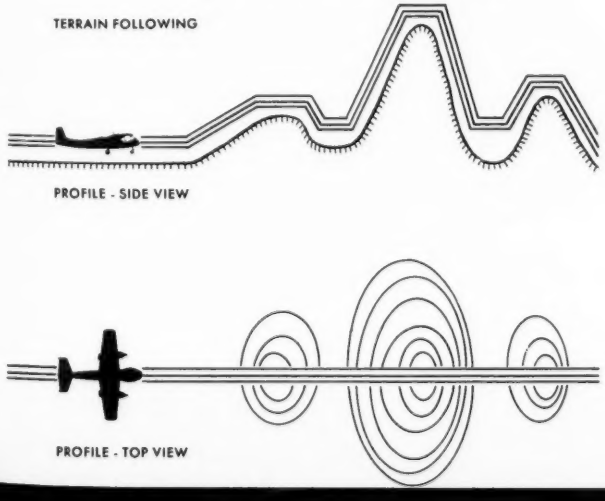
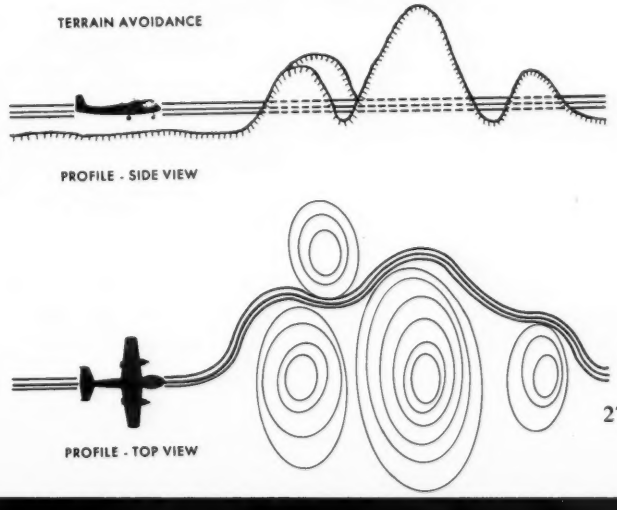


Figure 2. Terrain avoidance



The Army Aviation Story

Part IV

Rotary Wing Aircraft

M/Sgt Thomas M. Lang

BY 1945 commercial helicopters had become reliable enough to attract the attention of many Army officers who were keenly interested in adapting them to military usage. Army Ground Force (AGF) pilots were sent to the Bell Helicopter Company plant at Buffalo, N. Y., where they witnessed demonstrations of the YR-13.

On 25 November 1946 a contract was let for 27 YR-13s for the Armed Forces. Fourteen of these were earmarked for the AGF and became the first helicopters obtained for Army Aviation. Two of the 27 aircraft went to the Marines, two to the Coast Guard, and the rest to the Army Air Forces.

The AGF's first two YR-13s were picked up in early January 1947 by Capt Kenworthy Doak and Lt Robert R. Yeats. They accompanied the aircraft via Army Air Force transport plane to Ladd Field, Fairbanks, Alaska, for Arctic testing.

Shortly after, Capt Thomas J. Rankin and Lt Norman Goodwin picked up two more YR-13s and took them via surface transportation to Camp McCoy, Wis., for testing. Early in the summer of 1947 another YR-13 was taken to the Army Field Forces Board No. One at Fort Bragg, N. C., for testing. Later that aircraft was lost in an accident, but two more YR-13s were soon sent to Board One. The remainder of the original 14 went to the 82d Airborne Division at Bragg.

Early indications were that engineer and signal units would be the most logical users of helicopters. However, as tests progressed, the astonishing versatility of the helicopter became more apparent and plans were made to expand the helicopter program within the Army.

On 5 August 1947, Gen Jacob L. Devers, CG, Army Ground Forces (USCONARC) at Fort Monroe, Va., wrote a letter to the Chief of Staff, U. S. Army, requesting authorization for the purchase of 150 two-place helicopters. He also requested that 50 of the same type helicopters be procured for the Air Force in order to coordinate testing and training. The development of cargo helicopters was recommended.

In his reply of 8 September 1947, Lt Gen J. Lawton Collins, Acting Chief of Staff, approved all requests with the provision

that a corresponding reduction would be made in expenditures for other types of Army aircraft. The rotary wing program was well on its way.

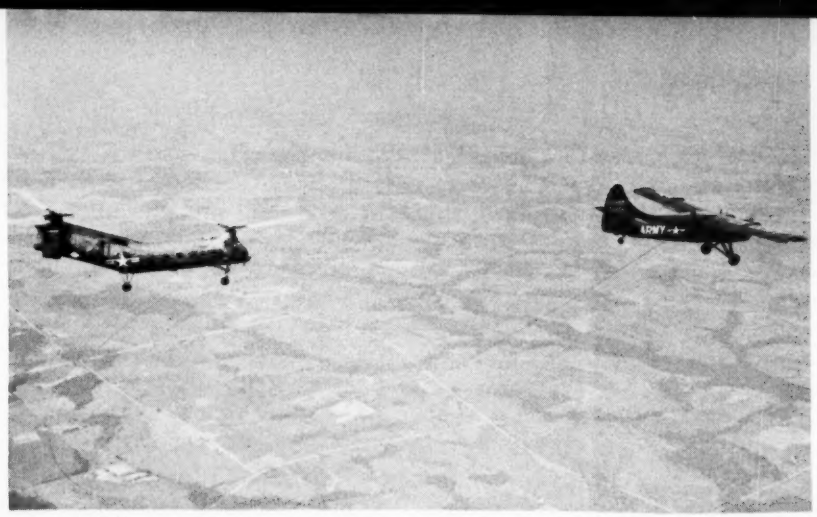
The H-13 underwent a series of modifications and continued to be a popular aircraft in the Army Aviation inventory. It was first flown in Korea at Ascom City in the winter of 1950.

The latest model (H-13K) was flown from Bell's Hurst, Texas plant to Fort Rucker, Ala., by Lt D. H. Olsen and SP-6 Richard C. Shelton on 11 February 1961. In testing this aircraft, Capt William H. Scanlan of the U. S. Army Aviation Board took it to an altitude of 20,000 feet.

Sikorsky's H-19 was first obtained early in 1952 and was used by the 6th Transportation Co. in Korea in December 1952. This was the first Army transportation company to support units in combat. During the last days of the Korean War, the H-19 afforded invaluable support in helping to halt a major breakthrough by transporting artillery ammunition to United Nations batteries.

Another of the larger helicopters in the Army Aviation inventory is Vertol's H-21 Shawnee. An Army H-21 nicknamed "Amblin Annie" was the first helicopter to fly nonstop coast to coast. It was flown by Maj Hubert D. Gaddis, Capt James Bowman and Mr. Joseph Givens. The flight stretched almost 3,000 miles and took about 30 hours. (See photo.) Recently Army H-21s have been used extensively in Vietnam to transport troops.

Hiller's H-23 was first obtained in 1950. It also saw service in the Korean War and has been used for topographic surveying. Today the H-23 is used primarily as a trainer at the Army Primary Helicopter School at Camp Wolters, Texas.



The H-34, built by Sikorsky, is considered by many today as the Army's most reliable helicopter. The first production model H-34 (No. 34475) was built for the Army in December 1954. In March 1962 it was assigned at Langley Field, Va.

The H-34 has been successfully armed with 4.5" and 2.75" rockets and with .50 caliber machineguns. (See photo.) Recently the H-34 was selected as one of the aircraft to be used by the newly organized 22d Special Warfare Aviation Detachment at Fort Bragg, N. C.

Sikorsky's H-37 Mojave is the largest helicopter currently in the Army inventory. Recently the Army began converting all of its H-37As to H-37Bs. The B model has a redesigned cabin door and cargo hatch and automatic stabilization equipment. The first B model was accepted at the Sikorsky plant on 7 June 1961 and flown to Fort Rucker, Ala.

Lighter and smaller than the mighty Mojave is Bell's HU-1 Iroquois, the Army's first turbine-powered helicopter. It serves as a mobile command post for troop commanders, for medical evacuation, and as a launching platform for SS-11 guided missiles.

The HU-1A can operate from small helipads on mountaintops because of its great power in proportion to relatively low weight.

Final type user evaluation testing by the U. S. Army Aviation Board at Fort Rucker began for the HU-1B on 28 November 1960. The Transportation Aircraft Test Support Activity at Fort Rucker received its first

HU-1B aircraft for logistical evaluation on 15 April 1961.

In May of 1961 the first of the overseas-bound HU-1B aircraft were accepted at Bell's Hurst plant by the Army and flown to a shipping point. Crews were Maj William R. Schmidt and SP-4 Leroy Fairchilds; Capt James Nichols and SP-5 William Gilkey; Lt J. C. Rothwell and SP-5 Malcolm Leighton.

The D is the latest model in the evolution of the HU-1 series. It was first flown in prototype form on 16 August 1961 at the Hurst plant and formally accepted by the Army at Fort Worth, Texas, on 18 November 1961.

These events had been preceded by the announcement on 8 July 1960 of the award of a $7 million contract for the further development of the HU-1 series.

As in the B model, the troop commander flying in the HU-1D is in constant contact with both his command and the pilot. Improved seating arrangements and larger windows enhance visibility, enabling all passengers to see the ground. The larger doors speed debarkation.

On 15 September 1961 it was announced that the Army had awarded a $491,000 contract to the manufacturer for further experimental research to bolster range and speed of the HU-1. Reports will be submitted to the Army in December 1962 and may result in production of another model.

The HC-1B Chinook evolved from an announcement made late in 1956 that Department of Army desired a new multi-turbine medium transport helicopter.

Industry was invited to submit design proposals for the aircraft in June of 1958. In August and September of that year a competition was held at Wright Air Development Center, Wright-Patterson Air Force Base, Ohio. Results were submitted to Department of Army in October. Army approval of the findings and subsequent development program were announced in February 1959. On 4 March the Army announced that Vertol's design had been accepted and requested that a formal aircraft proposal be drawn. This proposal was submitted in April followed by award of the letter contract on 22 May.

The mockup inspection was held 27-29 January 1960 at Vertol's Morton, Pa., plant. The HC-1B was first officially flown at Philadelphia International Airport on 19 October 1961.

It is anticipated that the HC-1B will replace the H-37, H-34, and H-21 helicopters.

R-1—Platt-LePage two-place (pilot and one passenger). Observation. The Army Air Forces obtained only one R-1 in FY 1944 and one R-1A in FY 1945. The R-1 had a 440 hp Pratt and Whitney engine (R-985-21) and the R-1A had a 450 hp Pratt and Whitney engine (R-985-AN-1).

R-2—Kellett. The Army Air Forces obtained one of these two-place aircraft in FY 1940 for evaluation. It was a modification of the YG-1C autogiro, and had a 300 hp Jacobs engine (R-915-1).

No drawings available

R-3—Kellett. The Army Air Forces obtained one of these two-place aircraft in FY 1940 for evaluation. A modification of the YG-1B autogiro, it had a feathering rotor and a 225 hp Jacobs engine (R-755-3).

R-4—Sikorsky, two-place (pilot and one passenger). Observation, reconnaissance and medical evacuation.

Models ranged through XR-4C and were used by the Army Air Forces. All models had side-by-side seating.

Model	*Total Obtained*	*FY First Obtained*	*Notes*
XR-4	1	1942	This model featured an antitorque tail rotor. It had a 165 hp Warner engine (R-500-3).
YR-4A	3	1942	This model had 180 hp Warner engine (R-550-1).
YR-4B	27	1943	This model was equipped with racks for litters or bombs. Three were transferred to the Navy. It had a 180 hp Warner engine (R-550-1).

Model	*Total Obtained*	*FY First Obtained*	*Notes*
R-4B	100	1944	This model had a range of 130 miles. Twenty were transferred to the Navy. It had a 200 hp Warner engine (R-550-3).
XR-4C	1	1943	This was a modified XR-4. It had a 180 hp Warner engine (R-550-1).

R-5—Sikorsky, two-place (pilot and one passenger). Observation. Models range through YR-5D. These aircraft were used by the Army Air Forces. All models except the YR-5D had 450 hp Pratt and Whitney engines (R-985-AN-5). The D model had a 600 hp Pratt and Whitney engine (R-1340).

Model	*Total Obtained*	*FY First Obtained*	*Notes*
XR-5	5	1944	Tandem-rotor model of which two were later converted to XR-5A. Other models were all single rotor.
YR-5	0	——	This model was redesignated and completed as the YR-5A.
XR-5A	2	1944	Modified XR-5.
YR-5A	26	1944	Each aircraft equipped with two litters. Two transferred to the Navy.
R-5A	34	1945	All transferred to the Navy and the Coast Guard. Sixty-six had been ordered but the contract was cancelled.
R-5B	0	——	Contract cancelled.
YR-5C	0	——	Contract cancelled.
YR-5D	20	1946	YR-5A with more powerful engine.

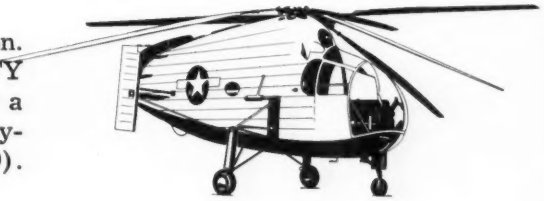
R-6—Sikorsky, two-place (pilot and one passenger). Observation. Models range through R-6B. These aircraft were used by the Army Air Forces.

Model	*Total Obtained*	*FY First Obtained*	*Notes*
XR-6	1	1944	Side-by-side seating. 225 hp Lycoming engine (0-435-7).
XR-6A	5	1944	Same as XR-6 except for 240 hp Franklin engine (0-405-9). Three of these were transferred to the Navy.
YR-6A-NK	26	1944	Same as XR-6A except manufactured by Nash-Kelvinator.
R-6A-NK	193	1945	Nash production model. Thirty-six transferred to the Navy.
R-6B-NK	0	——	Cancelled.

R-7 — Sikorsky. This aircraft was ordered in FY 1943. It was intended to be a redesigned XR-6A but the contract was cancelled before it was manufactured.

No drawing available

XR-8 — Kellett, two-place (pilot and one passenger). Observation. The Army Air Forces obtained one XR-8 and one XR-8A in FY 1945. The XR-8 had twin, side-by-side, three-bladed rotors and a 240 hp Franklin engine (0-405-9). The A model had twin, side-by-side, two-bladed rotors and a 240 hp Franklin engine (XO-405-9).



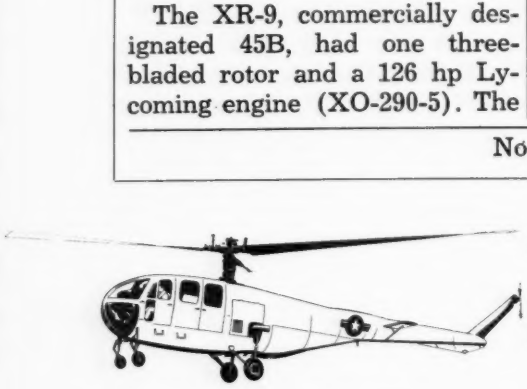
R-9 — G & A Aircraft, one-place. Observation. The Army Air Forces ordered the XR-9 and XR-9A in FY 1944, but delivery was never made. However, the AAF ordered and received one XR-9B in FY 1946.

The XR-9, commercially designated 45B, had one three-bladed rotor and a 126 hp Lycoming engine (XO-290-5). The A model, commercially designated 45C, had one two-bladed rotor and the same engine as the XR-9. The B model, a revised 45C, had a 135 hp Lycoming engine (0-290-7).

R-10 — Kellett, eight-place (pilot, passenger and six litters). Ambulance. The Army Air Forces obtained two XR-10s after ordering them in FY 1945. Each aircraft had twin intermeshing rotors and two 450 hp Pratt and Whitney engines (R-985-AN-5).

R-11 — Rotor-Craft, two-place (pilot and one passenger). Observation. The Army Air Forces obtained one XR-11 in FY 1946 for evaluation. The aircraft had two counterrotating, three-bladed rotors and a 100 hp Continental engine (A-100).

No drawings available of R-9, R-10, R-11.



R-12 — Bell, five-place (pilot and four passengers). Utility.

The Army Air Forces obtained 3 XR-12s and 10 YH-12Bs in FY 1948 (new designation given R models). These aircraft had 600 hp Pratt and Whitney engines (R-1340-55).

H-13 *Sioux* — Bell, two-place (pilot and one passenger with two external litters except for K model). Light observation aircraft. (Throughout 1948 type letter designations shifted from R to H and many models carried both designations. However, the H-13 seems to be the first model appropriately called H.)

The Army obtained its first YR-13 in December 1946 and by 30 June 1949, 14 R models were on the Army Aviation inventory. No more R models appear on the inventory after that. The YR-13 had a 175 hp Franklin engine (6-ALV-335).

H-13s used by the Army range from A through K, excluding F, I, and J.

Model	*Most Ever Carried On AA Inventory*	*FY First Obtained*	*Notes*
YH-13A	4 in December 50	1947	Previously designated YR-13.
YH-13C	1 in December 55	1950	Modified H-13B; used skid gears.
H-13B	59 in June 49	1949	Bell 47B; used wheeled gear and a 200 hp Franklin engine (0-335-3).
H-13C	22 in June 56	1952	Modified H-13B.
H-13D	73 in December 51	1951	Skid gear single controls and a 188 hp Franklin engine (0-335-5B).
H-13E	406 in December 53	1952	H-13D modified for side loads, same engine.
H-13G	229 in December 54	1953	Bell 47G; same engine as H-13D.
H-13H	368 in January 1962	1956	Bell 47G-2, 200 hp Lycoming engine (VO-435-23B).
H-13K	2 in January 62	1962	Three-place, with 220 hp Franklin engine (6VS-335 supercharged).

On 31 January 1962 the Army Aviation inventory carried 278 H-13Es; 184 Gs; 368 Hs and 2 Ks.

R-14 — G & A Aircraft. Observation. The Army Air Forces ordered three of these aircraft in FY 1946, but the contract was cancelled the same year before the aircraft were manufactured.

No drawing available.

H-15 — Bell, four-place (pilot and three passengers). Utility.

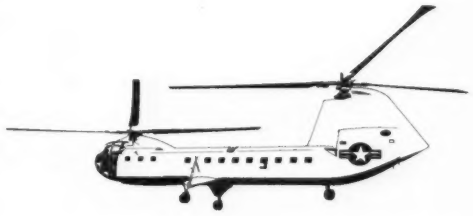
The Army Air Forces procured three XH-15s in FY 1950 for evaluation. Each aircraft used a 275 hp Continental engine (XO-470-5).

H-16 (H-27) — Vertol (Piasecki). Tandem rotors, heavy cargo.

The Army Air Forces ordered two XH-16s in FY 1946. Originally XH-16 was to be 43-place and to use two 1,650 hp Pratt and Whitney engines (R-2180-11).

The YH-16A, obtained in FY 1955, was the second XH-16 produced. It was first redesignated as XH-27 and then YH-16A. It was 44-place and used two Allison engines (T-38-A3).

The YH-16B, obtained in FY 1955, was the first XH-16 produced. It was first redesignated as YH-16 with the same engines and personnel capacity. As the YH-16B, it had a personnel capacity of 50 (including crew) and used two 2,100 hp Allison engines (T-56-A-5).



No drawing available.

H-17 *Flying Crane* — Hughes (Kellett), three-place (crew of two and one engineer). The Air Force obtained one XH-17 in FY 1953 for evaluation as a flying crane. The Army received evaluation data on the XH-17 from the Air Force. The XH-17 originally was a Kellett project, but was sold to Hughes.

H-18A — Sikorsky, four-place (pilot and three passengers). Utility.

The Army obtained four YH-18As for evaluation in FY 1950. Each aircraft had a 245 hp Franklin engine (0-425-1).

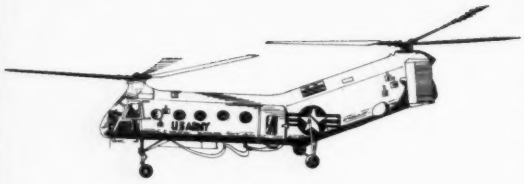
H-19 *Chickasaw* — Sikorsky, 12-place (crew of two plus 6 litters and one medical orderly, or 10 passengers). Light tactical transport. Models used by the Army range from A through D (excluding B).

Model	*Most Ever Carried On AA Inventory*	*FY First Obtained*	*Notes*
H-19A	1 in June 52	1952	Used 550 hp Pratt and Whitney engine (R-1340-57).
H-19C	72 in June 53	1953	Same engine as H-19A.
H-19D	240 in June 60	1954	Hydroclutch transmission; used 700 hp Wright (Lycoming) engine (R-1300-3).

As of 31 January 1962 the Army Aviation inventory carried 48 H-19Cs and 216 H-19Ds.

No drawing available.

H-20 *Little Henry* — McDonnell, one-place. Observation and reconnaissance. Two XH-20s were obtained by the Air Force in FY 1952 for evaluation.



H-21 *Shawnee* — Vertol, 22-place (crew of two and 20 passengers or crew of three and 12 litters). Light tactical transport.

The Army obtained its first H-21s in August 1954. The most H-21s ever carried on the Army Aviation inventory was 308 in December 1958. The Army also has 16 H-21Bs, which were acquired from the Air Force. Each H-21B and C has a 1,425 hp Wright engine (R-1820-103).

On 31 January 1962 the Army Aviation inventory carried 16 H-21Bs and 283 H-21Cs.

H-22 — Kaman, 2-place (pilot and passenger). Utility.

The Navy ordered one YH-22 for evaluation in FY 1950. It was commercially designated K-225 and had a 200 hp Lycoming engine (0-435-C).

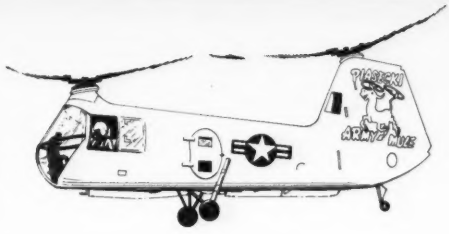
No drawing available.

H-23 *Raven* — Hiller. All models except F are three-place (pilot and two passengers or two external litters). Light observation aircraft. The Army obtained one YH-23 for evaluation in FY 1950. Models used by the Army range from A through F, excluding E.

Model	*Most Ever Carried On AA Inventory*	*FY First Obtained*	*Notes*
H-23A	82 in December 52	1951	Used in Korean War. Commercially designated Hiller 360. Used 178 hp Aircooled Motors (Franklin) engine (0-335-4).
H-23B	273 in June 56	1952	Same as A except wheels added to skids. Used 200 hp Aircooled Motors (Franklin) engine (0-335-6).
H-23C	137 in December 57	1956	Commercially designated 12C; same engine as "B" model.
H-23D	309 in January 62	1956	Used 225 hp Lycoming engine (VO-435-23B).
H-23F	4 in January 62	1962	Four-place; commercially designated Hiller 12 E4. Obtained for U. S. Army use in Inter-American Geodetic Survey mapping operations in Latin America. Plans call for purchase of 17 H-23Fs. Uses 305 hp Lycoming engine (VO-540-A1B).

On 31 January 1962 the Army Aviation inventory carried 224 H-23Bs; 119 Cs; 309 Ds and 4 Fs.

H-24 — Seibel, two-place (pilot and one passenger). Observation and medical evacuation. The Army obtained two YH-24s for evaluation in FY 1951. Each had a 125 hp Lycoming engine (0-290-11).



H-25A *Army Mule* — Piasecki, (crew of two with three to six passengers). Utility. The Army obtained its first H-25A in FY 1953. The most ever carried on the Army Aviation inventory was 63 in June 1955. Each H-25A uses a 550 hp Continental engine (R-975-46).

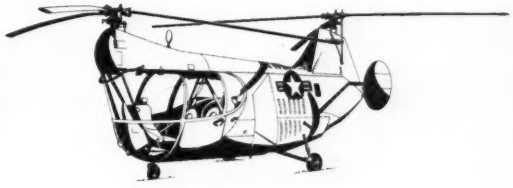
H-26 — American Helicopter, single place. Observation and reconnaissance. The Army obtained two YH-26s for evaluation in FY 1952. Each used two 48 hp American Helicopter engines (XPJ49-AH-3).

H-27 — See H-16.

H-28 — Hughes. This helicopter was designed as a revised version of the XH-17 but the contract was cancelled before any were manufactured.

H-29 — McDonnell. This helicopter was designed as a revised version of the XH-20 but the contract was cancelled before any were manufactured.

No drawings available of H-27, H-28, H-29.



H-30 — McCulloch, two-place (pilot and passenger). Observation, utility, and medical evacuation. The Army obtained two YH-30s for evaluation in FY 1952. Each used a 200 hp Franklin engine (0-335-5).

H-31 — Doman, pilot and three to seven passengers. Utility.

The Army obtained two YH-31s for evaluation in FY 1952. They were commercially designated LZ-5. Each used a 400 hp Lycoming engine (XO-580-1).

H-32 — Hiller, two-place (pilot and one passenger). The Army obtained six YH-32s for evaluation in FY 1954. They were commercially designated YHJ-1. Each used two 38 hp Hiller ram jet engines (B-69).

H-33 — See XV-3, Army Aviation Story, part V, next month.
No drawing available.

H-34 *Choctaw* — Sikorsky, 20-place (pilot, copilot and 18 passengers or eight litters). Light tactical transport.

The Army obtained its first H-34s in FY 1955. The most H-34As ever carried on the Army Aviation inventory was 423 in December 1958, and the most Cs was 190 in January 1962. The H-34A and C uses a 1,425 hp Wright (Lycoming) engine (R-1820-84A).

On 31 January 1962 the Army Aviation inventory carried 179 H-34As and 190 H-34Cs. (All of the Army's H-34s are being converted to C models.)

H-35 — See XV-1.

No drawings available of H-35, H-36.

H-36 — This designation was reserved for Navy use but was later cancelled and never used.

H-37 *Mojave* — Sikorsky, 26-place (crew of three and 23 passengers, or 24 litters, or 6,000 pounds of cargo). Medium tactical transport.

The Army obtained its first H-37 in 1956. In 1961 it began converting its H-37As to B models. The most H-37As ever carried on the Army Aviation inventory was 90 in June 1960. Both models use two 1,900 hp Pratt and Whitney engines (R-2800-54).

On 31 January 1962 the Army Aviation inventory carried 55 H-37As and 35 H-37Bs.

No drawing available.

H-38 — This designation was reserved for Navy use, but later was cancelled and never used.

H-39 — Sikorsky, four-place (pilot and three passengers). Observation. The Army obtained one XH-39 for evaluation in FY 1954. It was the third YH-18A modified with a 400 hp XT-51-T3 Aertouste engine.

H-40 — See HU-1.

H-41 *Seneca* — Cessna, four-place (pilot and three passengers). Observation. The Army obtained ten YH-41s for evaluation in 1957. Each used a 270 hp Continental engine (FSO-526A).

H-42 — See HO-2.

HU-1 *Iroquois* — Bell (See models below for seating capacity). Light tactical transport. The Army obtained its first YH-40 (later designated HU-1) in FY 1956. Models range through D (excluding C).

Model	*Most Ever Carried On AA Inventory*	*FY First Obtained*	*Notes*
YH-40	6 in December 58	1956	Six-place; 770 hp Lycoming engine (XT-53-L-1).
HU-1	8 in December 59	1958	Redesignated from YH-40.
HU-1A	158 in January 62	1959	Six-place; 860 hp Lycoming engine (T-53-1-A).
HU-1B	94 in January 62	1960	Nine-place; 960 hp Lycoming engine (T-53-L-5).
HU-1D		1962	Thirteen-place; 1100 hp Lycoming engine (T-53-L-9).

On 31 January 1962 the Army Aviation inventory carried 7 HU-1 aircraft (redesignated from YH-40).

HC-1A — Vertol, 23-place (crew of three and 20 passengers or 15 litters or 3,778 pounds of cargo). Cargo.

The Army obtained three YHC-1As for evaluation in 1959. They are commercially designated 107-2. Each used two 850 hp General Electric engines (T-58-GE-6).

HC-1B *Chinook* — Vertol, 36-place (pilot, copilot, crewchief and 33 passengers or 24 litters). Medium tactical transport.

The Army obtained its first YHC-1B in October 1961. Each aircraft uses two 2,200 hp Lycoming engines (T-55-L-5).

S-60 *Flying Crane* — Sikorsky. Pilot, copilot, 12,000-pound payload. Army leased the S-60 for 25 hours of familiarization flying in 1959. The S-60 was built around the engine and rotor system of the H-37.

XV-1 (L-25; H-35) — McDonnell, four-place convertiplane.

The Army obtained two XV-1 aircraft in FY 1954 for evaluation. Each used a 550 hp Continental engine (R-975-19).

Originally the XV-1 was designated XH-35 by the Army and XL-25 by the Air Force. The designation XV-1 was agreed upon as a compromise. Thus, this aircraft became the only one to hold three official designations.

XV-2 — Sikorsky. Commercially designated S-57, this was to be a convertiplane with a retracting rotor. Some design studies were completed, but the aircraft was never built.
No drawing available.

HO-1 *Djinn* — Sud, two place (pilot and one passenger). Observation and reconnaissance. The Army obtained three YHO-1s for evaluation. Each used a 240 hp Palouste IV, Compressed air, Turbomeca engine. This was the first aircraft to receive the Army's new observation designation.

HO-2 (YH-42) — Hughes, two-place (pilot and one passenger). Observation and reconnaissance.

The Army obtained five YHO-2s for evaluation. Each is commercially designated 269-A and each used a 180 hp Lycoming engine (0-360-C2B). This aircraft was originally designated YH-42 by the Air Force.

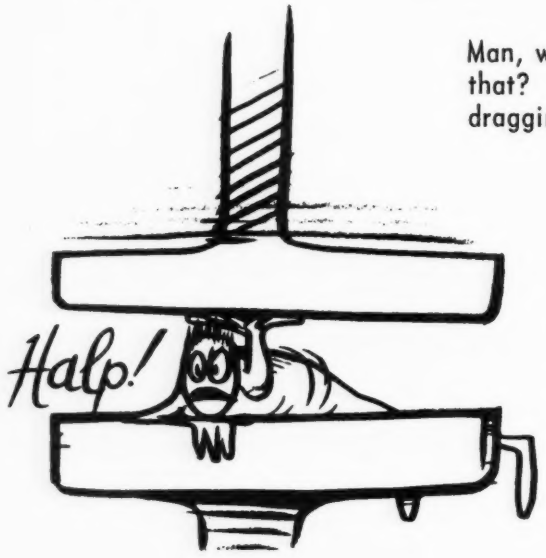
HO-3 — Brantley, two-place (pilot and one passenger, side by side). Observation and reconnaissance.

The Army obtained five YHO-3s for evaluation. Each is commercially designated B-2 and uses a 180 hp Lycoming engine (VO-360-A1A).

My Army Aviator's Helicopter Coloring Book

I am a passenger. I have just ridden with an aviator who likes to "show off." Color my face bilious green. Color my thoughts disgusted.

Man, what a party! Flight planning? What's that? Color my eyes red. Color my tail dragging.



I am a VFR aviator who flies between cloud layers. Color me like mashed potatoes.

I am an eager, alert Army aviator. I read my handbooks. Color my tail bushy. Color my eyes bright.

I am an eager beaver throttle jockey. I plan my flights with finesse and go over every detail with a fine tooth comb. Color me careful. Color me alive.

I used to be an Army aviator. I thought the AR-95 series made dull reading. Now I sell shoes. Color me blue.

I forgot to check my fuel. Color the helicopter Tholocco wet.

An Interesting Mission

Captain Paul J. Buchanan

"OK, she's in place — cut 'er loose!" And the pilot hits the cargo release button, pulls pitch, and smiles at the co-pilot. Another antenna has just been placed on the top of a 150-foot tall radio relay tower!

The problems involved in accomplishing this helicopter operation, though not world shaking in content, generally are of interest to helicopter pilots, aviation commanders, and a surprising number of tactical unit commanders, usually Signal. The lessons learned by pilots who have flown this type of mission also apply to a great many other missions involving helicopters and loads.

I would like to expound briefly upon considerations involved in this operation, such as justification, planning, continuity, and accomplishment of mission. Safety is a primary factor, and must be considered in all phases of the problem.

The first question that generally comes to mind is, "What are the advantages, if any, of using a $200,000 or more machine, not to mention the high hourly cost of operation and crew pay involved, to do a job which seems relatively simple and commonplace?"

Obviously, when antennas are installed on the *side* of a radio tower, a block and tackle type hoist is most easily used. However, to get a similar antenna, usually dish-shaped and weighing nearly 600 pounds onto the top of a tower, a crane-like superstructure must be built out, up, and over the top of the tower from which to raise the dish and mount it in place. The same arrangement must be made for the removal of an antenna. As can easily be seen, this is no small job and is not as inexpensive as might be imagined.

Among other factors which come into play is the fact that the helicopter can do the job much more quickly than any other means normally available, and any cargo helicopter pilot with some training and experience can do the job. In addi-

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Capt Buchanan was assigned to the U. S. Army Signal Brigade, Europe, when this article was written. He is dual rated with over 3300 hours flight time.

The many capabilities of Army Aviation give it a versatility limited only by the imagination of the user.

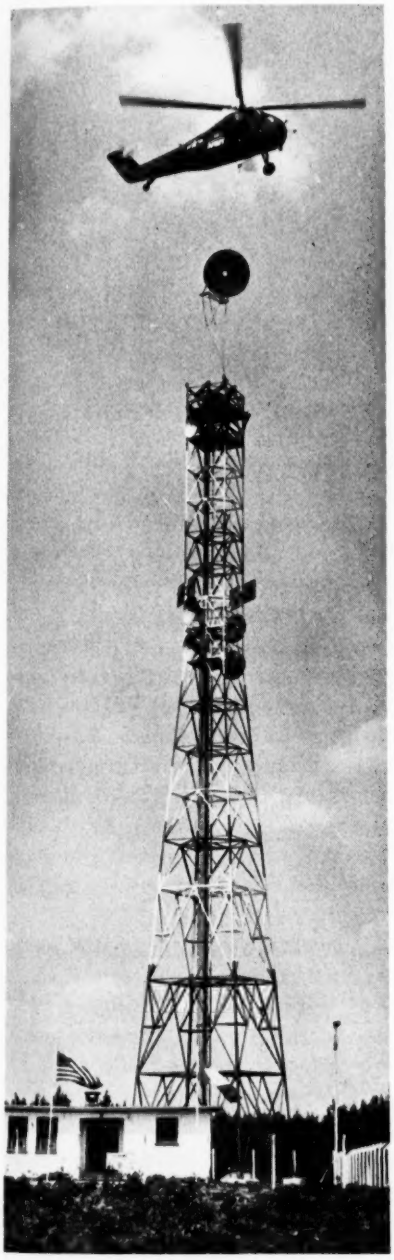
tion, the experience gained from this job in peacetime may be invaluable in an emergency situation. Risk is involved, as in any unusual mission, but it is fundamental that the risk diminishes in inverse proportion to the planning and forethought implemented by all concerned.

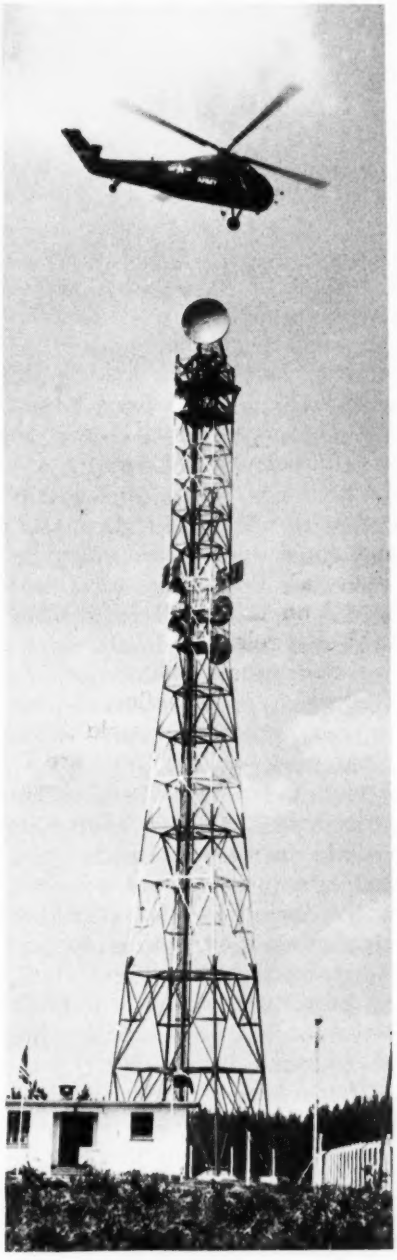
Once the idea to use a helicopter for an antenna job has been germinated, the wheels of action must roll, not haphazardly, but with continuity toward the final objective. Whether the initial planning is done by the aviation officer or the operations officer is of no great significance, as this will vary by unit, but it is very important that the crew of the helicopter be aware of all developments, eventually taking over all coordination with the using unit.

The date and time arranged for the mission must be compatible with all flight regulations and forecast aircraft availability. Arrangements must be made with local military commanders and military or civilian police for traffic control if the site is in a populated area.

The crew working upon the tower must also be kept abreast of all developments and be extremely familiar with the procedures as they are worked out. Extra equipment requirements must be determined early to eliminate the possibility of unnecessary delays. Any unit using helicopters in this manner should have an SOP defining all aspects of the operation, and everyone concerned must be familiar with these procedures.

Specific advantages of various modes of operation will be discussed further on, so assuming that all arrangements have been accomplished, we will move to the site of the radio tower. The crews should arrive a couple of hours before the prearranged installation time in order to have time to prepare thoroughly. Having the pilot and crewchief climb the tower to see at firsthand what will happen once the antenna is in place is advisable. The pilot must brief the tower team as well as his own crew, making certain that all are pro-





Left page, top left: Helicopter preparing to hook up to antenna.

Left page, top right: Helicopter picking up antenna.

Left: Antenna being lowered to top of tower. Right: Antenna in place on top of tower.

Removing antenna from tower. Cargo-carrying cable being attached to antenna.

ficient in the use of the necessary hand signals. He must also make an aerial reconnaissance of the area to determine wind direction, approach paths, emergency landing areas, and the flight path to be followed after removal of the antenna if such is the mission.

The pilot must be aware that at any great altitude above the ground he will have difficulty maintaining a constant hovering point above the tower. Also, his altitude control must be primarily by power and feel, since, as with hovering, it is difficult to establish a good relationship with ground checkpoints.

The accuracy of the standard altimeter in the helicopter is not accurate enough for this special use. The pilot's best vantage point is usually through his sliding cockpit window. He will not, however, be able to observe the tower and must follow the directions of the crewchief. The copilot should not attempt to aid with additional instructions unless an emergency arises, since confusion may result. The crew members inside the cargo compartment must be fastened by safety belts and may use either the bottom viewing port or the cargo door for directing the operation. The copilot should help watch the engine instruments and assist, as desired by the pilot, in use of the cargo hook switch, as well as watch the tower. Because of danger to the tower crew, the pilot should not perform any operation without advice of the crewchief.

The tower team must be secured to the tower by safety belts. One such team has used a safety belt about 15 feet long, which gives them great freedom of movement.

Remember, the helicopter may develop a static charge, so the tower team should wear gloves. They may ground the helicopter temporarily by striking the carrying cable with a chain or some similar arrangement. The antenna must be anchored to the tower at all times the helicopter is not attached to it.

One consideration pertaining to control of the antenna is stabilization. Guide ropes should be hung from the antenna for both removal and installation missions, for additional guidance to be given from the tower or the ground. In addition, steering ropes may be fastened to the antenna and strung inside the cargo compartment. However, if this is done, the ropes should be considerably longer than the main carrying cable and not fastened in any way inside the helicopter or loosely scattered, because of the possibility of having to drop the load.

Antenna being lifted from tower

Airspeed desired for carrying different loads will vary, but a slow airspeed is most desirable with a dish-type antenna, especially since the flight distances involved are usually short. Finally, the maximum engine rpm that can be maintained for a period of up to about 15 minutes, according to the flight handbook of the particular aircraft, should be used when the helicopter is actually in position over the tower.

As can be seen, this has been no lackadaisical maneuver! Any unit which will use the ideas set forth here, changing, adding, or deleting as required, or as their experienced pilots recommend, will surely accomplish their mission successfully, and will make a valuable contribution to a ground-bound sister unit's capabilities.

Here's the ultimate answer to VTOL design problems. Simple maintenance and operation, failsafe features that include no Murphy's Law parts, and economical operation. Take a tongue-in-cheek look at the problems design engineers overcame in developing the

New All Purpose VTOL

THE LATEST AND most advanced development in Army aircraft today is the XL-106 new century series Allgonequin. Meeting virtually all military characteristics for an all purpose VTOL aircraft, it is considered that adoption will result in substantial reduction of both logistic support requirements and pilots' insurance premiums.

Details as to powerplant and powertrain are classified. Among the unclassified characteristics of the XL-106, however, is a successful adoption of boundary layer control (BLC) which permits vertical takeoff at 50 percent power with maximum gross load conditions at density altitudes up to 30,000 feet.

Simplified design has resulted in a requirement of 16 man minutes of maintenance per flying hour. All flight surfaces as well as main and nose landing gear are interchangeable. In recognition of Murphy's Law, no part may be installed upside down or backwards without employing a 6-pound ball peen hammer and/or a 3-foot wrecking bar, which items will not be included in any aircraft tool or shop set.

Surface skin and structural members are of an elasticity and resiliency that permits takeoff and landing from small unprepared fields of sugar cane or scrub pine, and propellers will cut through powerlines of ½ inch diameter copper cable, provided penetration is made between the power poles.

Cruising and top speed are also classified, but it is reported that the nose section is constructed of a new material which will withstand penetration of the thermal barrier; yet, is a nonconductor allowing for mounting of the radar in the forward position where only a short lead is required to the navigation section of the electronic brain.

One of the most remarkable developments incorporated is the new AN/ARN EZ lightweight electronic brain mounted just aft of station 36. Flight controls, engine and flight instruments, powerplant and airfoils are all tied in with the brain in such a way as to produce some results surpassing the current state-of-the-art as follows:

- In the event hardware is overtorqued by the mechanic a distinct groan is emitted from the cabin loud speaker (in event of undertorquing a "squeeze me gently" is emitted in sexy feminine tones).
- If a component wears beyond tolerance during flight a tie-in between brain and local transceiver circuits automatically flashes a special requisition for the required item to the appropriate supply agency, together with shipping instructions to the destination airfield indicated in the current flight plan. Further, instructions are automatically issued to ATC to inform the pilot and alert required mechanics, and appropriate notations are entered by the airborne teletype in Block 26 of form 2391-2.
- In the event fuel or oil becomes low, a link with the approach coupler will cause the aircraft to take up a heading to the nearest servicing facility. When the fuel warning light comes on fresh Kleenex will be automatically ejected into the pilot's compartment at intervals of 1 minute.
- Flight plans received on the radio receiver are fed directly into the navigation section of the electronic brain, are read back over the appropriate transmitter by high-fidelity recorder and simultaneously stored in the memory section which is coupled directly with the automatic pilot. Between position reports, which are triggered automatically by station passage, required throttle

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Submitted by the United States Army Board for Aviation Accident Research. Author unknown.

adjustments are effected by the computer to meet established ETAs plus or minus 15 seconds.

• Aircraft serial numbers automatically disappear from all flight surfaces during "buzzing" operations, or by placing the "confuse" switch manually in the on-position serial numbers will be scrambled sufficiently to prevent identification.

• In the event engine instruments register out of limits or pilot manually overrides the autopilot, a neoprene finger will nudge the pilot in a sensitive area and appropriate instructions will be fed into the intercom from the high-fidelity unit employing appropriate flight-instructor-type profanity. Neon redlines on instruments also flash when exceeded and appropriate corrective adjustments are simultaneously made automatically by the brain.

• The automatic pilot, under direction from the brain, takes control during pre-landing and landing operations. Automatic taxi and shutdown operations are now nearing completion of development.

• In recognition of the fact that no manmade product is foolproof provisions for emergency procedures are also under development. Plans now underway, if successful, will eliminate the requirement for "−1" handbooks and literacy among aviators. In the event of crisis the crew will be automatically instructed to proceed to the crew's lounge where they may relax in overstuffed chairs provided for the purpose, and appropriate instructions will be issued softly through the high-fidelity circuit (with an accompaniment of appropriate background music). Initial plans called for equipping the emergency lounge with airfoam cushioned chairs, each of which has a self-contained ejection seat complete with quick opening parachute, electro-thermal lap robe, and emergency ration kit containing pre-mixed martinis, soup, salad, and filet mignon. This plan, however, has been abondoned since it was feared that, according to sentiment existing in congressional circles, provision of such equipment might jeopardize aviator's flight pay.

In closing, although the unit production cost of this aircraft is expected to be substantially higher than existing models, universal adoption would produce off-set savings as follows:

1. Substantial reduction in maintenance personnel and parts requirements.

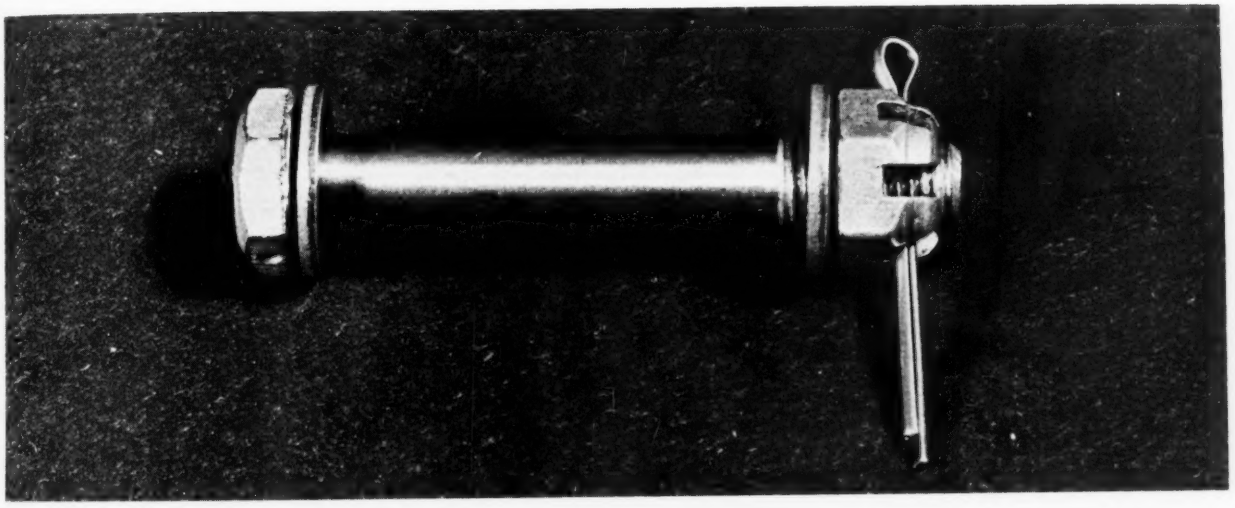
2. Closing of virtually all aviation training schools (pilot training requirement would consist of 3 day TDY to New York City for the following POI: First day, trip by elevator to top of Empire State Building (altitude acclimation); second day, wearing of the uniform (to include wings, crash helmet, and jodhpurs); third day, graduation* (a.m.) and R&R (p.m.).

* Initial flight pay checks will be affixed to the diploma.

CRASH SENSE

PREPARED BY THE UNITED STATES ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

A Matter of



Life or Death

"NOW APPROACHING from your left is the H-13H Sioux. A two bladed single rotor and tail rotor type helicopter, the Sioux is designed for training, observation, reconnaissance, rescue and general utility missions. It . . . " The announcer's voice continued a blaring description of the aircraft to some 1,000 ROTC cadets crowded along the edge of the tarmac at an Army airfield. Many of the cadets were getting their first look at Army Aviation and their eyes eagerly followed the chopper as it made a low pass across the field.

They watched as it climbed away, then returned and landed. "The pilot will now demonstrate a normal takeoff, followed by a steep approach and landing. The steep approach is used to land the aircraft in confined areas. Note how . . . " The cadets shaded their eyes against the hot afternoon sun as they watched the chopper climb rapidly toward the end of the field. It circled downwind, then made a steep approach and landed again.

"Next, we'll see how the aircraft gets out of a confined area. The pilot will demonstrate a maximum performance takeoff. Watch how . . . " The announcer's voice continued as the Sioux lifted off and climbed vertically.

". . . crashing on mast and bubble"

"Many of you are probably wondering what happens if the engine fails in flight. Fortunately, this doesn't often occur, but when it does, the pilot goes into autorotation and retains complete control. This will be the next demonstration . . ."

The cadets watched as the pilot closed his throttle and autorotated to the runway. "That's how you do it over open terrain. Now he'll show you how it's done to a spot. This would be required for landing . . . "

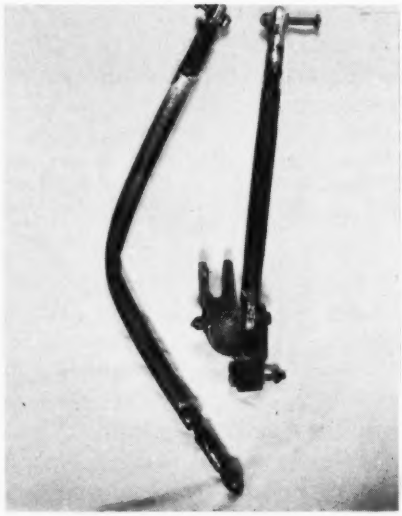
The cadets watched as the Sioux took off toward the west, made a 180° turn, and passed in front of them at an altitude of approximately 100 feet, traveling at about 80 knots. It started a climb to gain altitude for the spot autorotation. Suddenly, everyone could sense something wrong. The Sioux went into an extreme nosehigh pitch attitude and the pilot was seen to shove forward desperately on the cyclic, trying to get the nose down. He was unsuccessful and the aircraft entered a partial hammerhead stall, falling back on its tail to an inverted attitude. It dropped to the ground, crashing on the mast and bubble, and immediately burst into flames. The tail boom, sheared by the main rotor blade during the fall, dropped some 50 feet from the main wreckage. The pilot was killed by impact forces.

INVESTIGATION FINDINGS

The pilot had 1,174 rotary wing flying hours and he had flown 460 hours in H-13 aircraft. He had practiced the demonstration that morning and experienced no difficulty. He did not exceed the operational limitations of the aircraft.

Investigation revealed that the bolt (P/NA/N 174-16) which attaches the cyclic fore and aft push-pull tube (P/N 47-724-064-7) was missing from the main wreckage. With the aid of a witness and mine detectors, the missing bolt was located 260 feet from the main wreckage and along the flight path at a point near where the aircraft began the pullup prior to the accident. The missing bolt, when found, had no nut, but still had one washer near the bolt head. The cyclic push-pull tube, cyclic fore and aft control lever, and bolt were sent to a laboratory for analysis.

Recovered parts sent to laboratory



Following is the laboratory analysis:

1. Examination of the bushings in the bell crank (P/N 47-724-064) showed no evidence of a bolt having been sheared. There was no lip turned over from high compressive loading, distortion making the bushing egg-shaped, or other marks which could not be accounted for during normal handling.

Bushings in bell crank showed no evidence of sheared bolt

2. A mark in the aluminum of the bell crank was made by a steel rivet in the control tube (P/N 47-724-072-11). The tube had bottomed out against the bell crank, a condition which can only occur with the bell crank's forward end free and unrestrained.

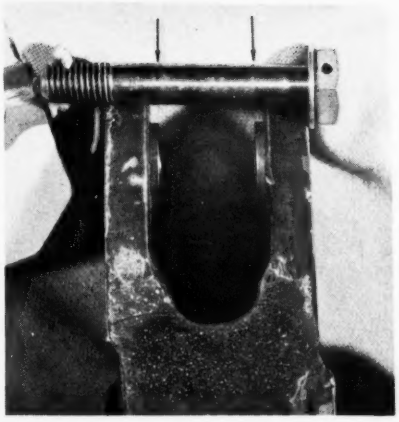
Mark in bell crank

3. False brinelling, a wear phenomena, was observed when the rod end bearing on the control tube was dismounted. The absence of static brinelling further indicates the bolt was not in the system at the time of the failure.

Inner race of rod end bearing shows false brinelling

4. Measurements of the wear pattern on the recovered bolt correspond to the lengths of the rod end bearing and bushings. Further, the washer under the head of the bolt had yielded to match the slight recess of the bushing shank below the surface of the aluminum bell crank.

5. The location of the bolt,



Bolt found by mine detector matches bell crank

found along the flight path, the size, shape, and location of wear marks, and the washer markings established the bolt as having come from the crashed aircraft. Absence of physical damage to the bolt indicated the nut most likely was not properly safetied.

With the cause of the accident pinned down, the big question remains . . .

WHY?

The WHY of this accident is an echo of the why of an H-21 accident described in the July 1962 DIGEST — SLIPSHOD MAINTENANCE!

The crewchief stated that he had *removed several controls, including the fore and aft push-pull tube,* a few hours before the accident.

The exact time this maintenance was performed could not be determined because NO WRITEUPS WERE PLACED IN THE −2.

The crewchief further stated that he had received NO SCHOOL TRAINING IN AIRCRAFT MAINTENANCE.

The crewchief's only training consisted of four months on-the-job training with fixed wing aircraft and two months on-the-job training with rotary wing aircraft. With this little amount of training and a 670 MOS, he was assigned as crewchief for this aircraft two weeks before the accident happened.

AR 611-201 lists the following duties for the 670 MOS:

"Assists in operation of Army airfield or forward airstrip and participates in periodic inspection, removal, and replacement of assemblies and sub-assemblies of fixed and rotary wing aircraft. Performs maintenance and repair functions described below *as directed and supervised by aircraft mechanics and repairmen.* Participates in removal and replacement of aircraft components, such as voltage regulators, starters, batteries, carburetors, magnetos, and ignition systems. Inspects and cleans engine and power train components and services hydraulic systems. Removes and installs propellers and rotors and makes minor repairs and adjustments as required by qualified repairmen. Traces and locates malfunctions in electrical systems by following wiring diagrams and using multimeter. Removes, tests, and replaces aircraft instruments following prescribed handling procedures. Cleans and applies preservative to external surfaces and internal areas of aircraft, and prepares aircraft for storage. Performs operational duties required at Army airfields, such as checking oil and refueling aircraft, guiding taxiing aircraft, ground handling and mooring of aircraft, operation of radio-telephone and airfield lighting equipment, auxiliary aircraft starting units, and engine warming equipment. Acts as member of fire and crash rescue team and clears obstructions from airstrips, taxiing, and parking areas."

The skills and knowledges re-

quired for the 670 MOS, as listed by the same regulation state: ". . . must know safety precautions to be exercised when working around aircraft."

". . . must know fuel, *lubricating*, and similar servicing requirements of fixed wing and helicopter aircraft. *Must know purpose and use of Army aircraft service inspection, and maintenance publications, forms, and records.*"

Aircraft are no more immune to shoddy treatment than aviators. We insist that only highly qualified professional doctors serve as flight surgeons to treat the ails of our aviators. Why not give the same break to the aircraft they fly?

Continued from page 17

when you cut the second engine you will start the glide with airspeed to spare if you need it. With a lot of runway in front of you and a few extra knots on the indicator, you will find that the tenseness will abate somewhat, and you will nonchalantly look around to see if there is something else you can do.

I looked nonchalantly around on my own glide and was chilled by the sight of a prop blade on the second feathered engine appearing at a 45° angle from top center, which meant one of the bottom blades would surely strike the runway. I hastily turned the key and selector switch back on and jabbed frantically at the start button again —and again nothing happened. This time I had forgotten to turn the master switches back on which I had cut off several seconds back. However, a more searching look at the prop blade disclosed it to be more like 4° off rather than 45°, so I let it go.

My other big error was the thought in the back of my mind that, like the D model, the L-23F had a nose wheel sticking partially out of the well and that it would run on three wheels on a wheels-up landing.

It doesn't.

The nose wheel does not stick out of the well, and the airplane center-of-gravity is *AFT* of the main gear when the gear is up —*just like the book says it is.* When the gear is up, that nose wheel is out of sight up in the well. When the forward speed of the airplane dissipates to the point where it will no longer remain balanced on the two main wheels (which protrude about 6 inches out of their wells), then the F model will fall backwards, not forwards, and it will ride on the fuselage section under the cabin door, leaving the nose and tail high in the air.

The important point to that observation is that, with the forethought that the aircraft will balance on two wheels for the longer part of the wheels-up run down the runway and then fall backwards, you have a very excellent chance of saving the props by holding a little back pressure on the control column immediately following your touchdown. You won't need this back pressure at all once the airplane loses its forward momentum, but initially it will serve to keep the nose from bobbing too far downwards on a rough runway, or when—and if—you apply brakes. (But gently, old man, gently.)

And so—to sum up.

When you feather the first engine, don't forget to flip the start selector switch to turn the dead prop around.

Feather the second one at 500 feet and 110 knots on the approach and plan on a pleasant (!) and shallow glide to the ground. If you are limited on runway length, you might want to cut that airspeed down. If you do, remember, the book says that the airplane will stall at 84 knots, clean.

When you touch down, hold it level on two wheels. If you are on a rough runway, or if you use brakes, hold a little back pressure to keep the nose from falling downwards.

And that is it. I close with a couple of afterthoughts.

When you are faced with a hung gear, don't panic and crank the good gear down to the point where they are stacked —that is, the actuators are bound—and you can't get them back up again electrically. If you do that, man, you got trouble, because then you have two down and locked and one of them is going to fold; and when you land—well—like man, that's a little bit out of my line.

If you are fairly certain that the hung gear will fold on touchdown, and time is important to you, don't bother with the foam routine. Foam on the runway is not a real requirement where the airplane is going to land level on its wheels, even if those wheels are only 6 inches out of their wells. Also, foam will hurt braking action if it is needed. And besides, if you land and miss the foam, you will be terribly embarrassed.

Don't forget to smile at the crowd as you exit the airplane, and later when you face the accident investigation board, be brave.

Winners of Annual Writing Awards Contest Receive Checks

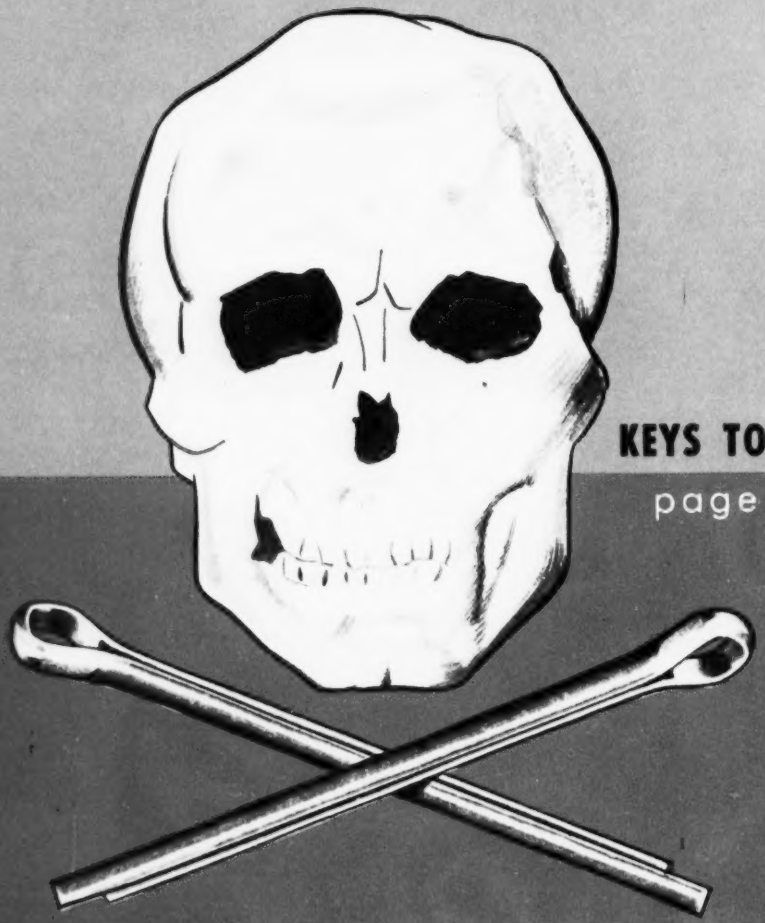
TOP RIGHT: Captain Forrest H. Williams, first place winner, receives a check for $125.00 from Colonel Warren R. Williams, Asst Commandant, U. S. Army Aviation School, Fort Rucker, Alabama.

CENTER RIGHT: Brigadier General Carl I. Hutton, U. S. Army (Ret), second place winner, receives a check for $75.00 from Brigadier General William B. Kunzig, Chief of Staff, Sixth U. S. Army, Presidio of San Francisco, California.

BOTTOM RIGHT: Lieutenant Colonel George Rogers, third place winner, receives a check for $50.00 from Brigadier General Delk M. Oden, Director of Army Aviation, ODCSOPS, Department of the Army.

You, too, can be a winner in the Annual Writing Awards Contest. The FY 63 contest is now underway. This is a fine opportunity to increase your value to the Army and the Army Aviation program by improving your writing abilities. A professional military man of today must be able to express himself clearly and concisely in writing as well as in speech.

Get your entry in today. All entries should be mailed to: Editor-in-Chief, U. S. ARMY AVIATION DIGEST, U. S. Army Aviation School, Ft Rucker, Ala. Although articles will not be judged on the art work or photos submitted, appropriate pictures, diagrams, charts which will enhance your material will be most welcome.



KEYS TO...?

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